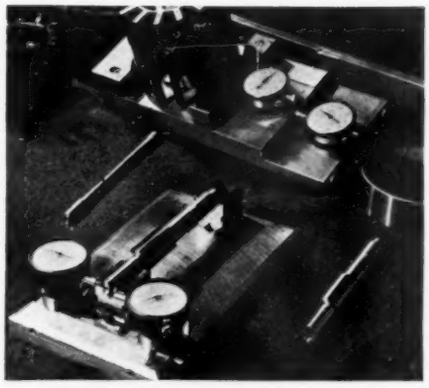
AMERICAN MACHINIST

December 27, 1939



Savings Indicated—*Dial indicators built into ingenious fixtures permit economical inspection of thousands of plastic parts (page 1074)*

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VOLUME 83 — NUMBER 26

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To Men Of Good Will

WE are come to that time of year when the entire Christian world observes the Nativity, when we consider the Biblical blessing, ". . . on earth, peace, good will toward men."

We have cause this year particularly to consider that blessing poignantly, for many of the nations of the earth are plunged into war, and over many others hangs the threat of the sword.

Even in America, our joyful thoughts in this holiday season are tempered with the fear that we may eventually be forced to take part in the conflict, that we may again be drawn into a "war to end all wars." For again we find the strong oppressing the weak, the doctrine prevailing of "might makes right."

We have especial cause in our industry to consider these things seriously, for just as we provide the backbone of peace, so are we called upon to provide the sinews of war. Yet it is not the metals, or us who work them, who are responsible for war—it is those strong minds, mad for power, that bend other and weaker minds to their will.

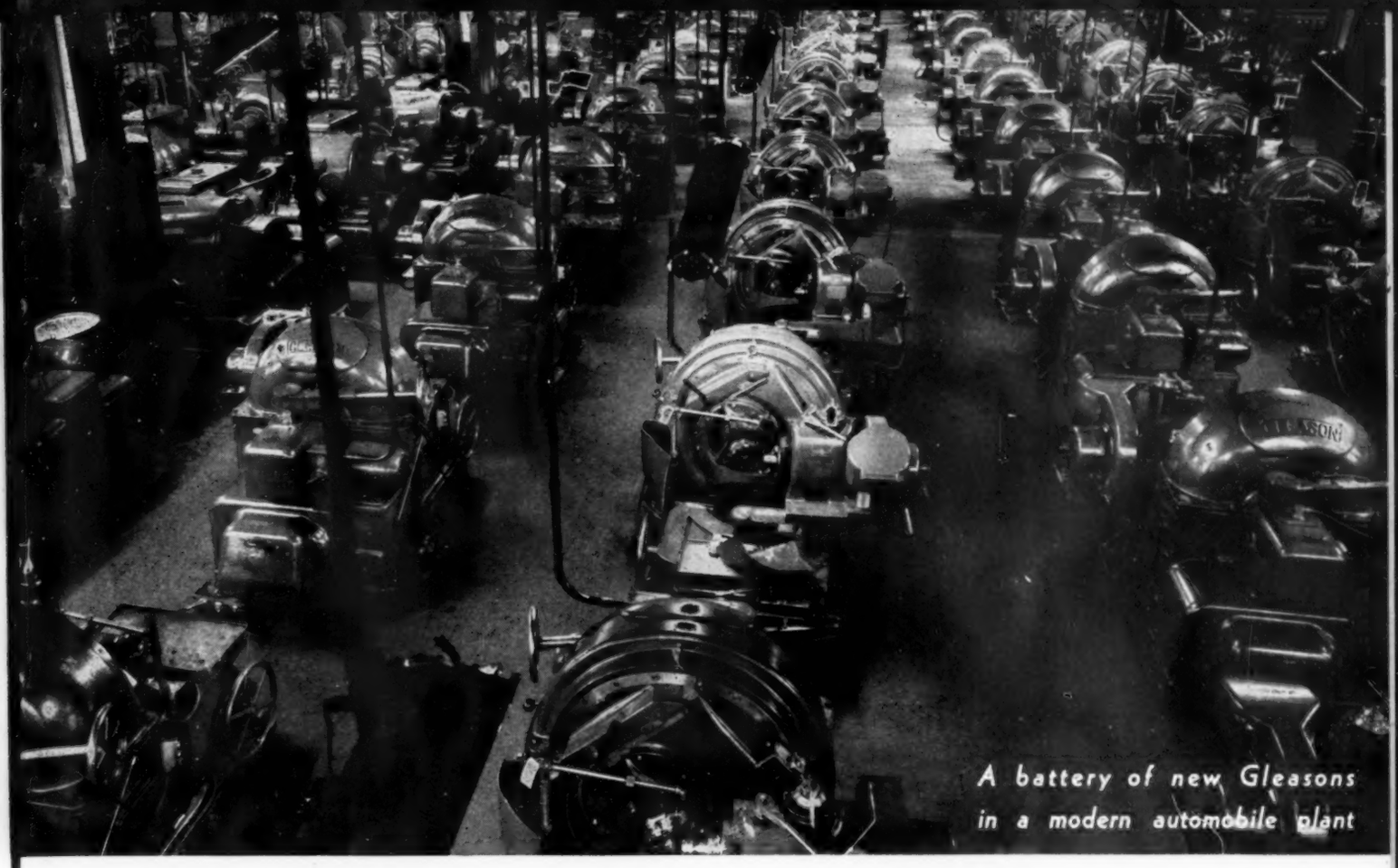
Our civilization has not progressed spiritually and morally as rapidly as it has mechanically. Though we in America are nationally at peace, we still have far too much internal strife. There is still too much distrust and misunderstanding between state and state, between employer and employees, between man and his brother. Force can be of no more assistance in solving these problems permanently than it is in assuring a lasting peace.

Yet the lasting solution is as obvious as the day, once we consider the true meaning of that Biblical phrase. It is not as translators have recorded it, ". . . on earth, peace, good will toward men." The literal translation of *. . . in terra pax hominibus bonae voluntatis* is ". . . on earth, peace *to men of good will.*" It thus becomes not a blessing, but an injunction. It promises lasting peace when we have become men of good will, when we have developed mutual trust and understanding between man and his neighbor, between employer and employee, between state and state, yes, between nation and nation. It requires our endeavor, individual and collective, to bring our cultural and social development up to the practical level of our mechanical progress.

Such a social advancement alone can make our Christmases truly merry and our New Years lastingly happy. May we all soon learn to help these things to come to pass.

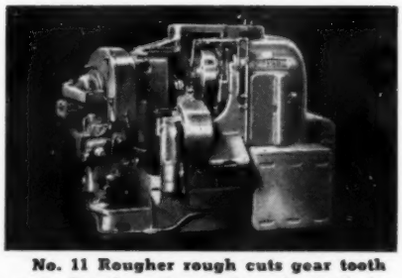
AMERICAN MACHINIST

"They shall beat their swords into plowshares and their spears into pruning hooks; nation shall not lift sword against nation, neither shall they learn war any more."—ISAIAH II, 4

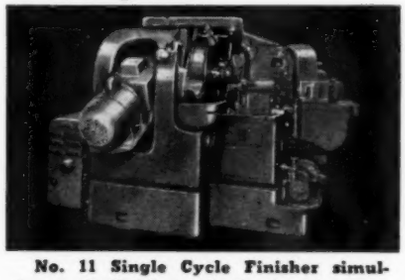


A battery of new Gleasons in a modern automobile plant

MODERNIZE TO DIVIDE YOUR GEAR CUTTING HOURS BY FOUR



No. 11 Rougher rough cuts gear tooth and chamfers the tooth ends—both in 5.7 seconds per tooth.



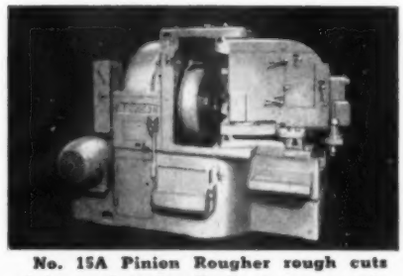
No. 11 Single Cycle Finisher simultaneously finish cuts both sides of a gear-tooth space in 5.0 seconds.

TODAY 15 minutes plus modern Gleason Machines rough cut and finish cut the teeth of a typical passenger-car hypoid drive gear and pinion.

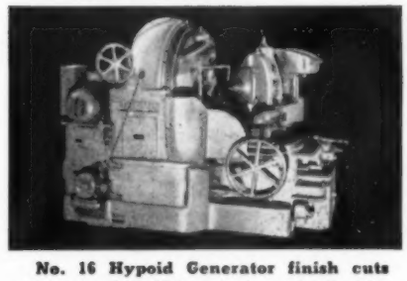
54 minutes plus obsolete machines will rough cut and finish cut the same gear and pinion.

MODERNIZE WITH GLEASONS

Can you afford to spend one hour on a quarter-hour job? Obviously not. To save time and money modernize with new Gleason Machines.



No. 15A Pinion Rougher rough cuts pinion teeth to close limits at average rate of 14.4 seconds per tooth.



No. 16 Hypoid Generator finish cuts pinion teeth in 25.1 seconds per tooth side.

GLEASON

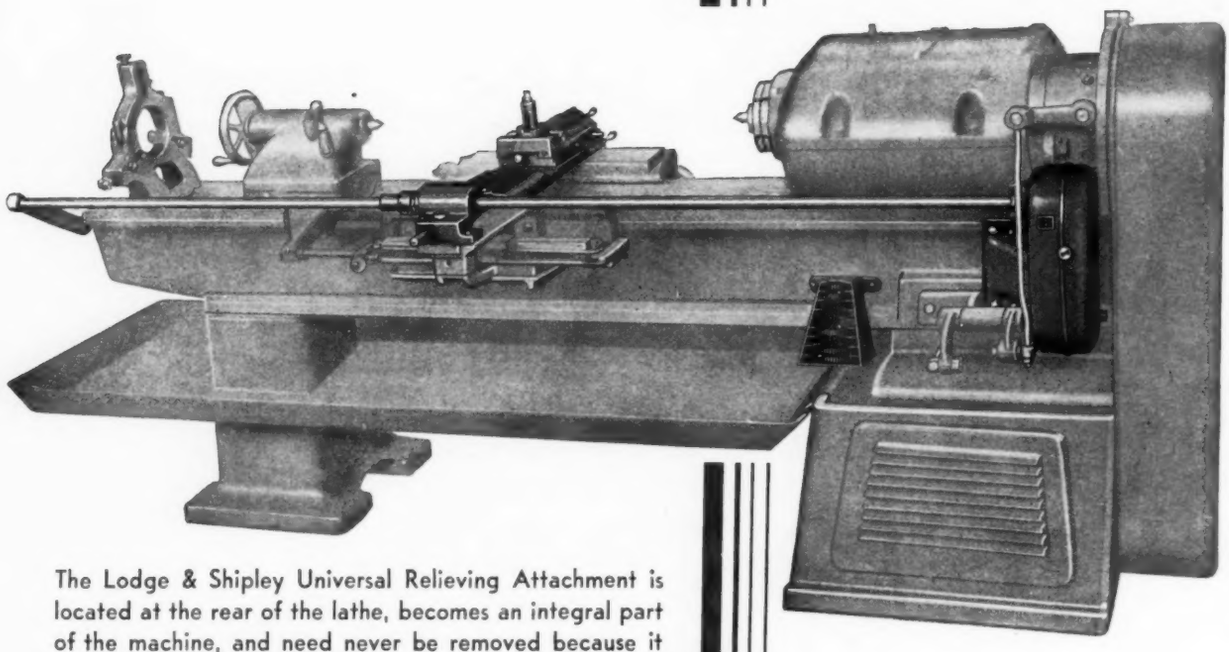
GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy Years

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

The tool is adjusted

LODGE &



The Lodge & Shipley Universal Relieving Attachment is located at the rear of the lathe, becomes an integral part of the machine, and need never be removed because it in no way interferes with regular operation.

Widely adaptable—high in precision—simple—sturdy—durable.

Helical (or Spiral) Flute Relieving

THE LODGE &

to the work

SHIPLEY UNIVERSAL RELIEVING ATTACHMENT

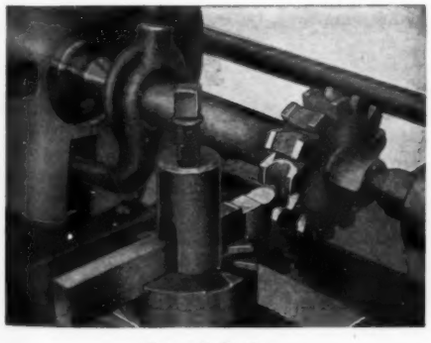
is Self-contained and an integral part of machine

THE Lodge & Shipley Universal Relieving Attachment is a time saver with outstanding operating conveniences.

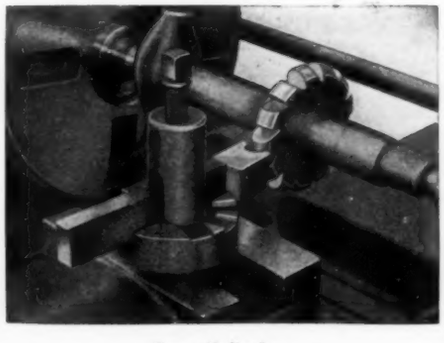
By providing a method of adjusting the tool to the start of relief on the workpiece, set-up time is considerably less than that required when work must be changed to suit the position of the tool.

Fully universal, the Lodge & Shipley Relieving Attachment can be used for right or left hand leads, end, internal or external, plain, angular or spiral relieving work. It may also be used in conjunction with the taper attachment.

Let us show you how you can take advantage of the operating conveniences offered by the exclusive features incorporated in the Lodge & Shipley Relieving Attachment—to eliminate lost time and unnecessary movements on the part of the operator. Ask for complete detailed information.



Form Relieving



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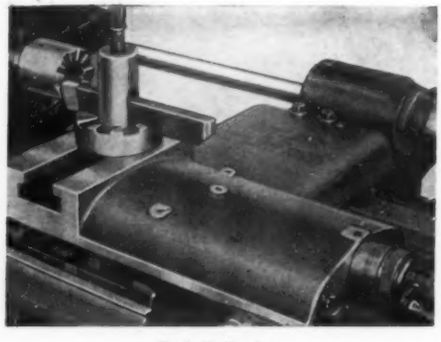


End Relieving

SHIPLEY MACHINE TOOL COMPANY
CINCINNATI, OHIO, U. S. A.

LET THE

Machine—CINCINNATI No. 3 Vertical Dial Type Miller.
Part—Cylinder body.
Material—Cast iron.
Operation—Mill gripper edge; also mill keyway and pads.
Stock Removal—.0125".
Diameter of Cutter—4" end mill.
Cutter R.P.M.—78.

SAVE WITH A *New* CINCINNATI

PRESSES

ROLL...?

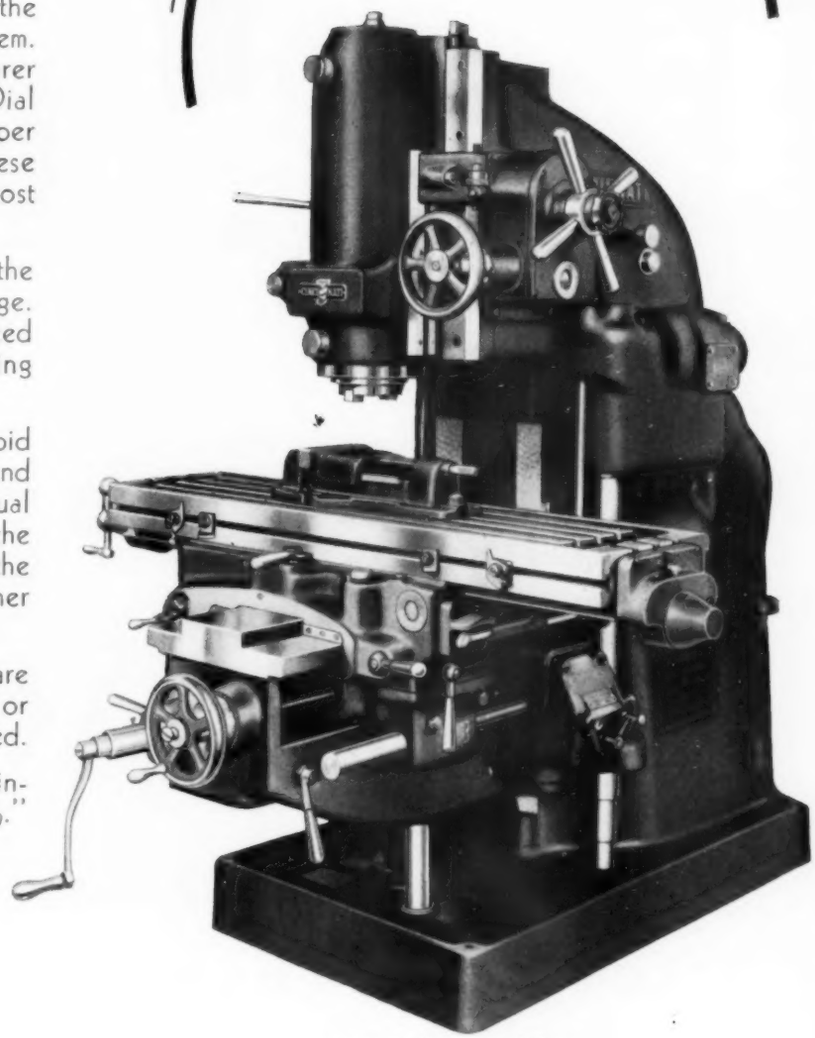
WHEN the presses roll, they roll on the accuracy and workmanship built into them. That's why this printing equipment manufacturer uses the CINCINNATI No. 3 Vertical Dial Type Miller to mill keyway, pads and gripper edge on cylinder bodies. He does all of these operations easily, quickly, and at low cost per piece.

Basically sound design makes possible the straightness required for the gripper edge. Power feed to the head . . . speed and feed changes by power at the front operating position are time savers on this job.

CINCINNATI Dial Types have power rapid traverse in six directions to eliminate fatigue and to save time . . . complete front and rear dual controls so the operator can always "see the job" . . . and many other features making the Dial Type a very popular machine for either manufacturing or general purpose work.

CINCINNATI Dial Type milling machines are built in Nos. 2, 3, 4 sizes, in Plain, Universal or Vertical styles, High Speed or Medium Speed.

Write for Catalog No. M-712, and an interesting, pictorial folder, "Save 15% to 40%."



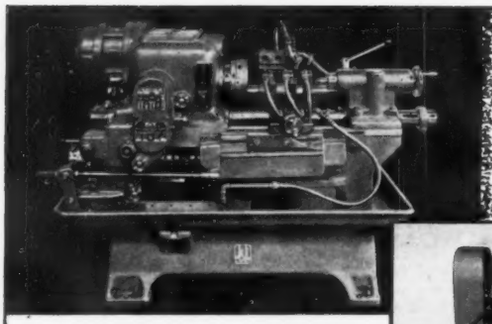
No. 3 Vertical Dial Type
Milling Machine.

THE CINCINNATI MILLING MACHINE CO.

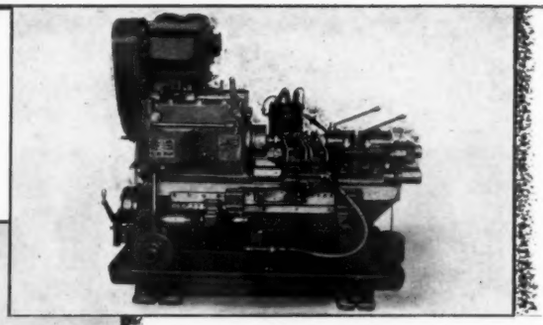
CINCINNATI

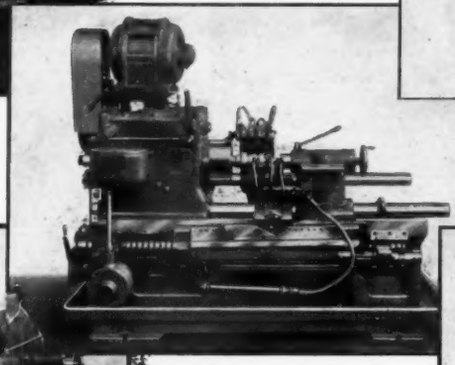
Cincinnati, Ohio, U. S. A.

A SYMBOL OF A DEFINITE STANDARD OF WORTH

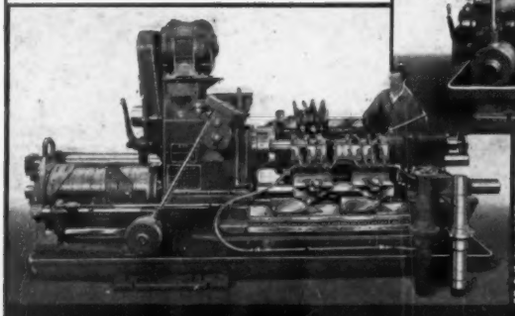


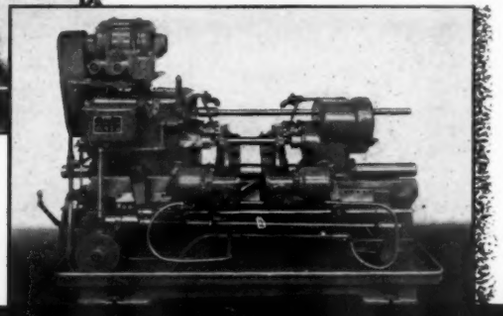
FAY
AUTOMATIC
LATHES



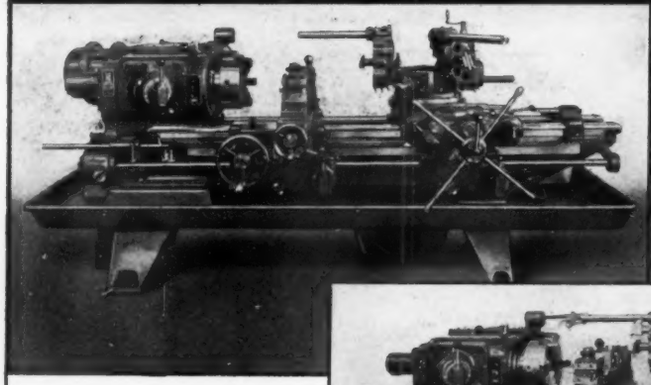


DOUBLE END
MILLING & CENTERING
MACHINES





THE JONES & LAMSON LINE



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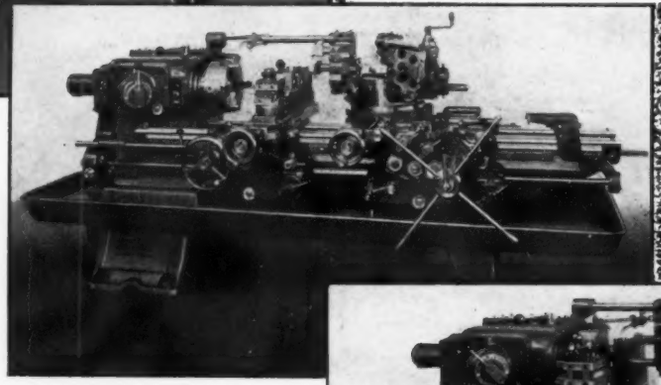

UNIVERSAL
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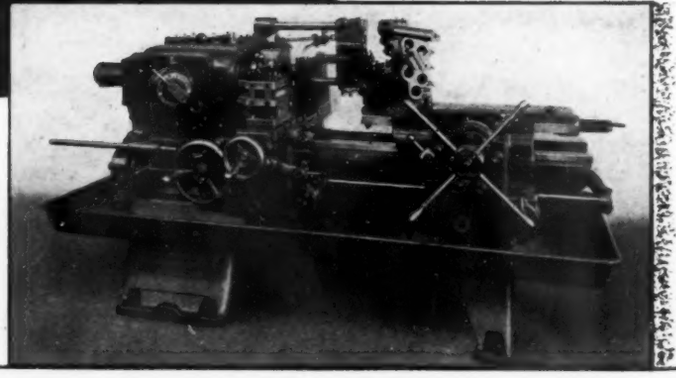
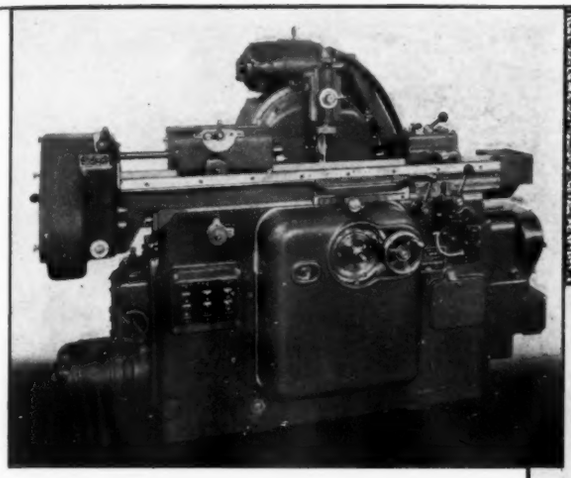
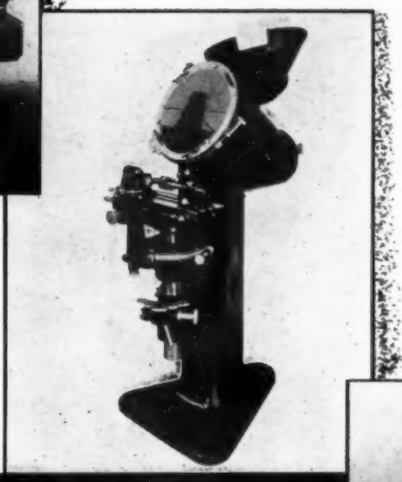


JONES & LAMSON
MACHINE COMPANY
Springfield, Vermont, U. S. A.



THREAD GRINDERS



COMPARATORS

OF MACHINE TOOLS

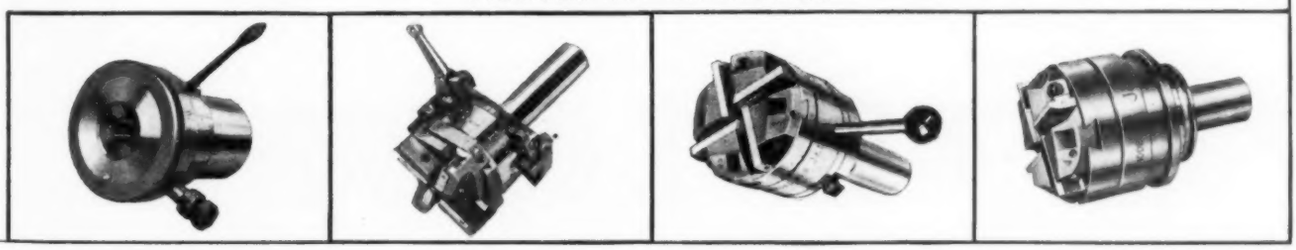
AT THE close of the year, man is apt to review the past and to look forward with renewed confidence and hope to the future, to consolidate achievement and to plan further progress.

We wish at this time to thank our many friends for their confidence and good will as expressed in the past and we welcome the opportunity to continue these relations, with mutual profit and progress in the attainment of still greater success in the future.

Yours for continued Peace and Prosperity.

JONES & LAMSON MACHINE CO.
SPRINGFIELD, VERMONT, U. S. A.

AUTOMATIC DIE HEADS



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ON FELLOWS AU

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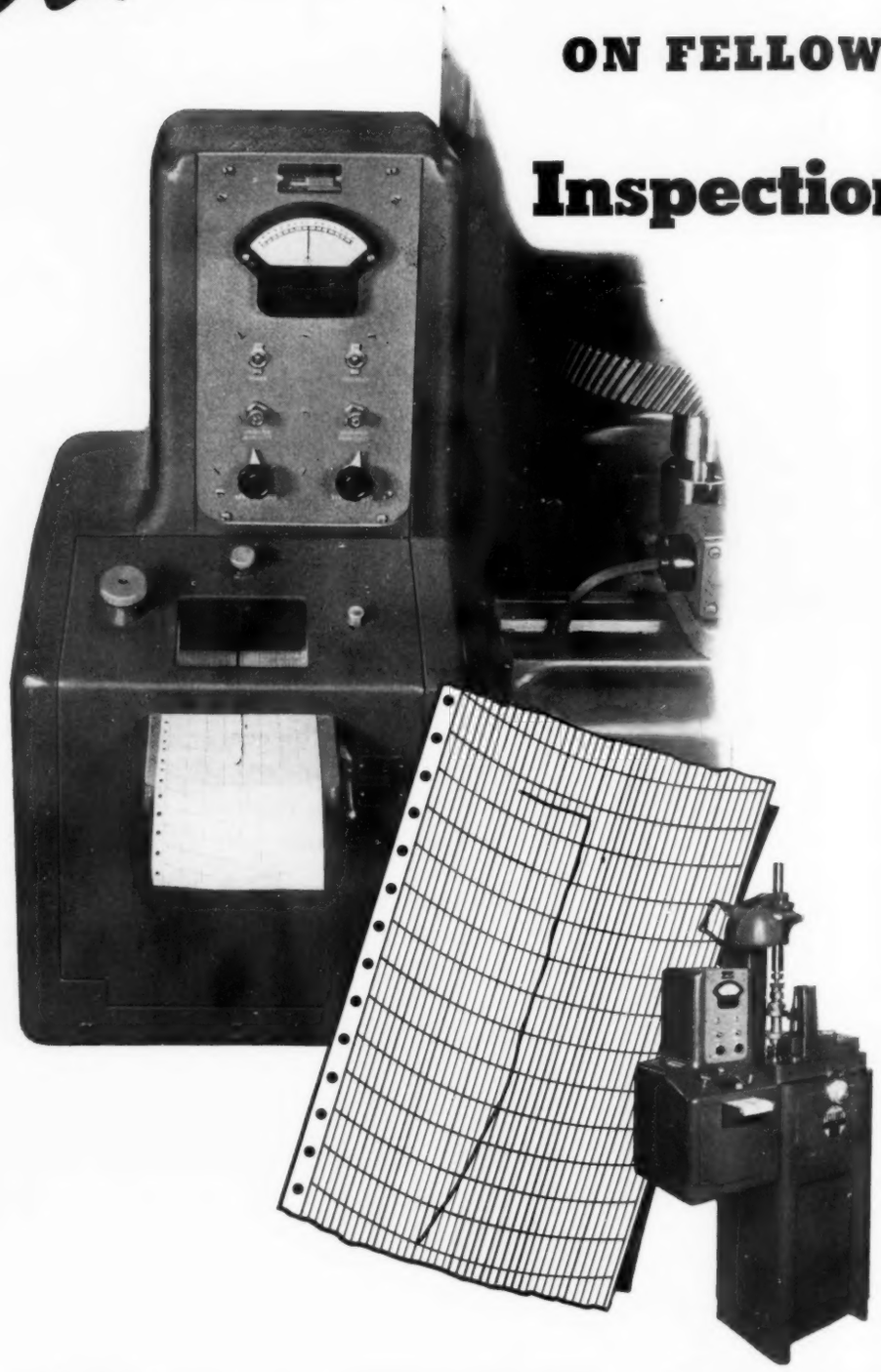


A CHECK OF THE INVOLUTE PROFILE IS INVALUABLE IN DETERMINING MANY REQUIREMENTS, AMONG WHICH ARE:

- to prove that new designs meet engineering specifications
- to check machine setup
- to determine if cutter requires resharpening
- to check new or resharpened cutter
- to check machine adjustments
- to determine if profile has changed during heat treatment
- to check accuracy after final finishing

When you know what you are getting you can prevent serious losses before they occur.

THE FELLOWS GEAR S

78 River Street Sp

Gear Tooth Profiles

AUTOMATIC RECORDING DEVICE FOR

Records *beyond question*

A PERMANENT, ACCURATE, DEPENDABLE RECORD, INDEPENDENT OF THE HUMAN ELEMENT, MAKES THE NEW FELLOWS INVOLUTE MEASURING MACHINE INVALUABLE...

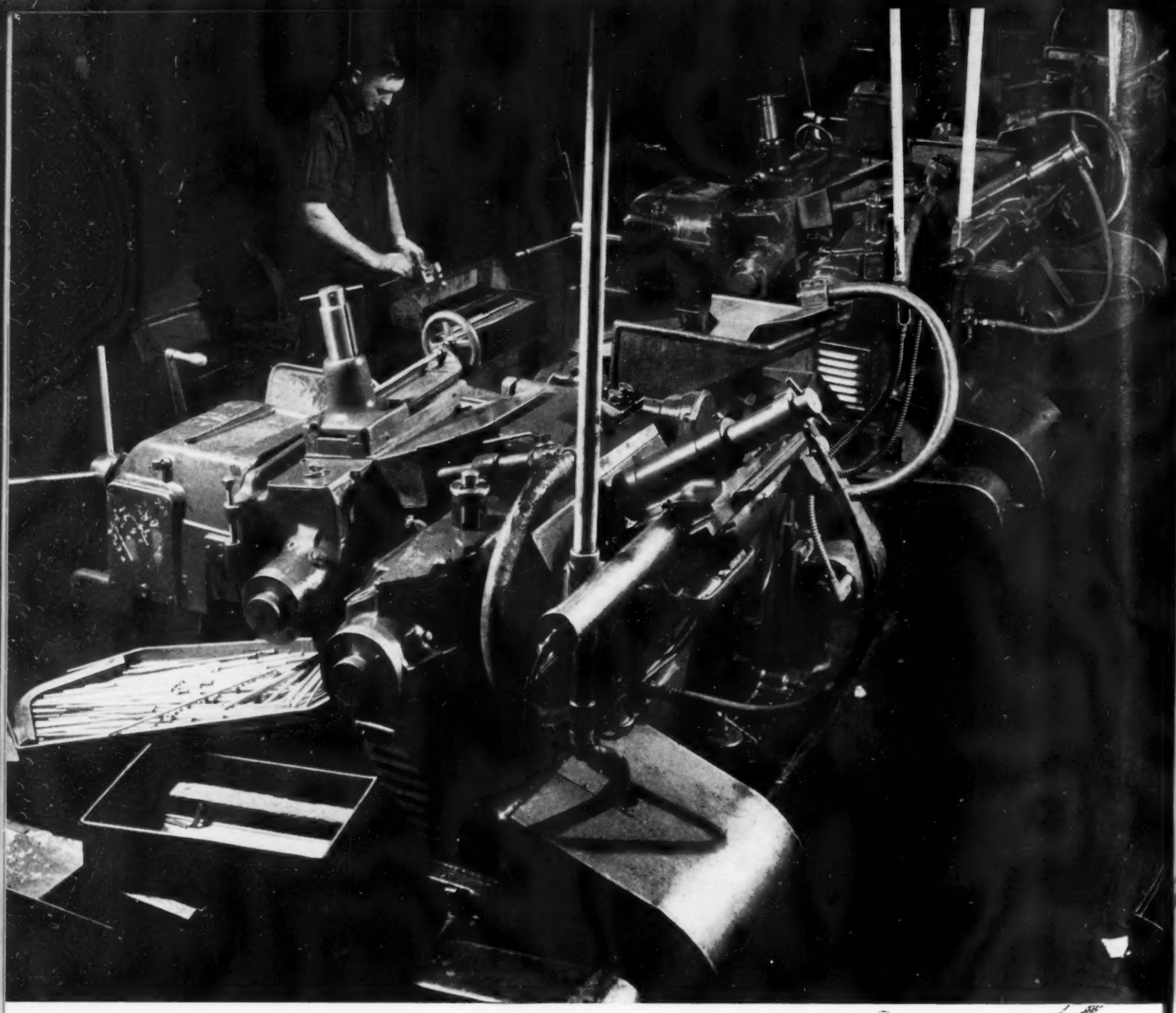
You can keep each stage of your production under positive control, minimize reject losses, and banish troublesome disputes. These machines are simple to operate, and change-over from one gear to another involves only the substitution of standard size blocks. No costly base rolls. No calculations required. The floor space requirement is small and the entire equipment self-contained. The maintenance of precise adjustment of these machines is easily verified by a calibrated master supplied with each machine. You should know all about the advanced design of these machines. (Three sizes: 6, 12 and 18 inch capacities.) Write for descriptive bulletins.

FELLOWS
Complete Line for Precision Gear Manufacturing

GEAR SHAPERS
RACK SHAPERS
COMPLETE LINE OF CUTTERS
THREAD GENERATORS
MASTER GEARS
LAPPING MACHINES AND LAPS
HELICAL CUTTER SHARPENERS
BURNISHING MACHINES
TESTING EQUIPMENT

FELLOWS GEAR SHAPER COMPANY

Springfield, Vermont—or 814 Fisher Bldg., Detroit, Mich.



SAVE WITH A *New* CINCINNATI

CINCINNATI Centerless Grinding Machines
are built in Nos. 2, 3 and 4 sizes.

Both Centerless and Center Type Grinders

STRAIGHT THRU

to 1/3 the cost...

THE "thru-road" to lower grinding costs is on the Centerless highway. CINCINNATI Centerless Grinding Machines have drastically reduced costs, stepped up production, improved finishes on an almost unlimited variety of parts in many different industries.

For example, the picture shows three CINCINNATI No. 2 Centerless grinders—acting as one machine—rough grinding textiles spindles by the thrufeed method. The continuous set-up turns out 350 pieces per hour while rough grinding, with a stock removal of .008"—.010" on each machine. Costs have been cut by two-thirds on this job since this Centerless set-up was adopted. The same set-up is also used for the finishing operation.

All CINCINNATI Centerless Grinders have the ***exclusive*** FILMATIC grinding wheel spindle bearings. Of multiple shoe construction, steel-backed and bronze-lined, they are self-adjusting for variations in load resulting from heavy or light cuts. Completely submerged in oil under pressure, self-renewing, wedge-shaped oil films rigidly and accurately support the spindle at all times. A simple and reliable construction; does not seize on heavy, roughing cuts; is smooth running for high-grade finishing cuts.

Embodying this ***exclusive*** FILMATIC spindle bearing, plus its built-in ability to produce fine finishes, extreme accuracy and high production, make the CINCINNATI Centerless Grinder a profitable investment for you.

Write today for Catalog G-424.

CINCINNATI GRINDERS INCORPORATED

CINCINNATI, OHIO, U. S. A.

CINCINNATI

A SYMBOL OF A DEFINITE STANDARD OF WORTH

New No. 22-L
Table size: 45" x 10".
Feed range: 26" x 11" x 17".
Ram movement: 19".

VAN NORMAN

THE New Van Norman No. 22-L Ram Type Universal Milling Machine provides greater flexibility, ease of operation, compactness and sturdiness for tool room, experimental or pattern shop work. Precision built, of a heavy, rigid design, the No. 22-L has front and rear controls for all power feeds, 6-way rapid traverse, and a wide range of speeds and feeds.

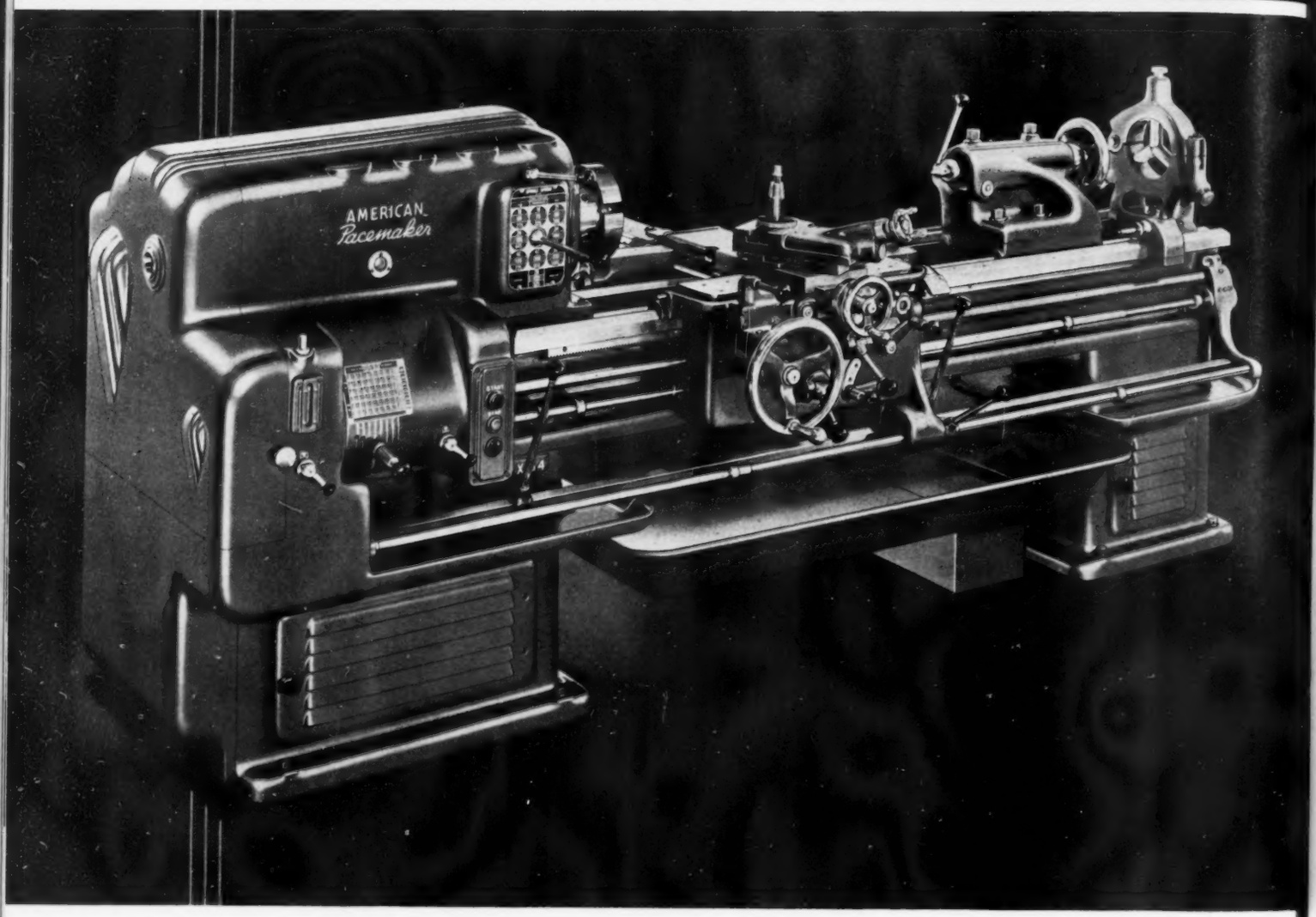
Vertical, horizontal and angular milling can be done without attachments and with fewer set-ups, saving man and machine time. Four other ram type models available. Write for bulletins.

VAN NORMAN MACHINE TOOL COMPANY

Springfield, Massachusetts

MILLING MACHINES

THE NEW "AMERICAN" PACEMAKER TOOL ROOM LATHE



SENSITIVE ●

ACCURATE ●

DEPENDABLE ●

The "AMERICAN" PACEMAKER – brand new in design – incorporates the very latest and most modern characteristics of advanced lathe construction, resulting in a new conception of tool room lathe efficiency. Ask for detailed information.

THE AMERICAN TOOL WORKS CO., CINCINNATI, O.

LATHES RADIALS SHAPERS

OPPORTUNITIES FOR SAVINGS *in the line of tools you buy again*

UNION METAL SLITTING and SLOTTING SAWS

ALL tools in the complete UNION line offer opportunities for savings. UNION METAL SLITTING AND SLOTTING SAWS, for example, can be depended on for maximum service and faster cutting action—for more cuts at lower cost per cut. Every type of metal saw is available in standard sizes.

UNION production facilities—second to none in the small tool industry—assures prompt service on every requirement.

UNION TWIST DRILL CO., ATHOL, MASS.

STORES—New York Store: 61 Reade St. • Chicago Store: 11 So. Clinton St. • San Francisco Store: 121 Second St. • Los Angeles Store: 524 East Fourth St. • Seattle Store: 568 First Ave., So. • Detroit Store: 6540 Antoine St.

MANUFACTURING DIVISIONS—S. W. Card Mfg. Co. Div.: Mansfield, Mass. • Butterfield Division, Derby Line, Vt., and Rock Island, Quebec • Representatives throughout the world.

TWIST DRILLS • MILLING CUTTERS • REAMERS • HOBS • SLITTING SAWS • END MILLS • TAPS • DIES • SCREW PLATES • PROFILE CUTTERS

FOR THE ULTIMATE IN MODERNIZATION

LANDISIZE

LANDMACO

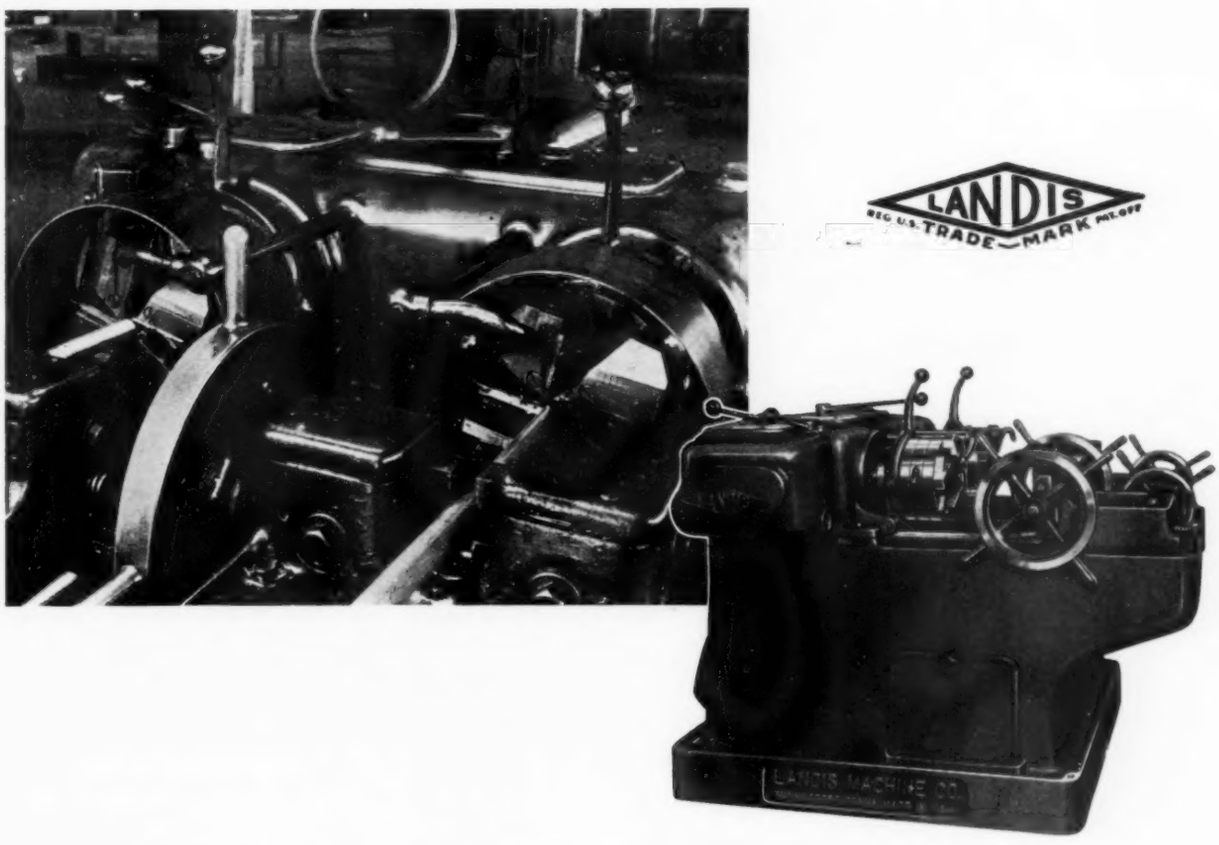
The LANDMACO Threading Machine with Landis Tangential Chaser proves to be the profitable "low cost" way to better quality threads.

The above illustration shows a LANDMACO threading Machine in the plant of a West Coast manufacturer of food machinery.

LANDIS MACHINE C
WAYNESBORO, P

your THREADS

—*the Profitable Way*

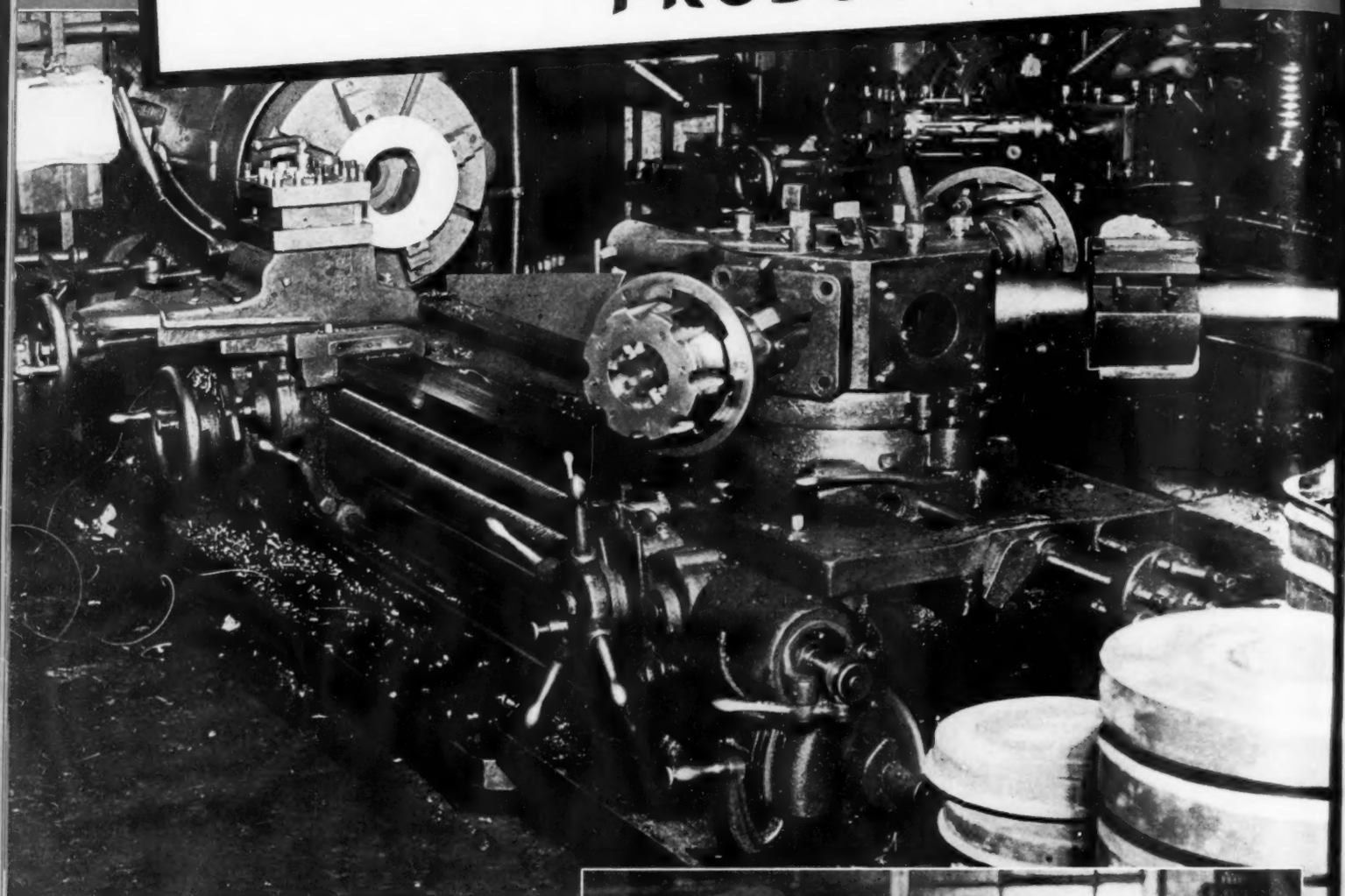


Threading leg rods for Canning Machinery, this LANDMACO produces 400 of these rods or a total of 8000 inches of threads per grind of the chasers. The threads are held to close tolerances at a cutting speed in excess of 55 feet per minute, and an average of more than 100 rods are threaded per hour. Naturally the threading cost is very low.

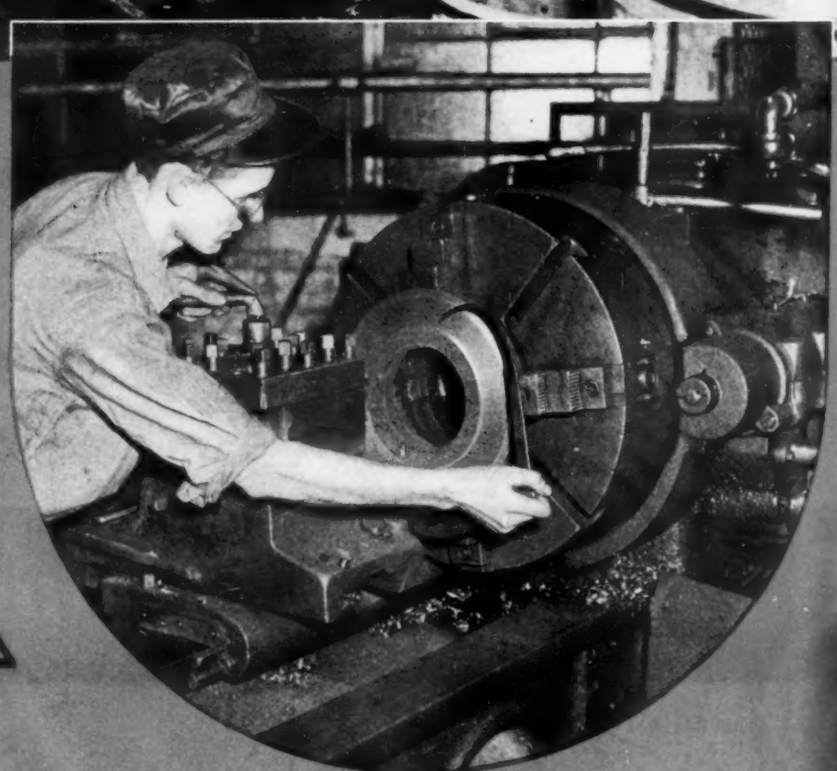
Write for more details about the LANDMACO Threading Machine

E COMPANY, Incorporated
PENNA., U. S. A.

DOUBLE *the* PRODUCTION!



★Send for bulletins which give the full story of Libby Turret Lathes—tables are shown giving principal dimensions of all sizes. Libby sales engineers are available for conference at your convenience.



Libby UNI-FLEX TURRET LATHES

CMC CLEARING

KROPP FORGE CO., CHICAGO

uses Four

Libby TURRET LATHES

IN MAINTAINING

BUSY OPERATING SCHEDULE

★The Libby Turret Lathe featured here has been in operation for five years. It is seen machining flanges to be used on fittings.

Three operations are preformed on each flange—facing, threading, boring. Twice the amount of production is realized on this Libby over the former machining method.

This is just another example of the ability of Libby Lathes, not only to give high precision results, but to also produce a greater output.

Libby Turret Lathes are built with strength sufficient so that they can really withstand continuous heavy duty operation. More than that, they are designed to take work even over their rated capacities.

Libby Turret Lathes prove, in a wide variety of installations, that they get the utmost out of new high-speed cutting tools. See one in action—how it takes the heaviest cuts in the toughest materials worked.

Let us discuss your requirements with you and show you how a Libby Turret Lathe can fit into your operating requirements for higher quality, faster, and more economical results. Our production facilities are such that you can get early delivery on the type and size Libby you select.

INTERNATIONAL MACHINE TOOL COMPANY, INC.

INDIANAPOLIS, INDIANA

Division OF CLEARING MACHINE CORPORATION · · · CHICAGO, ILLINOIS

NORTON SERVICE
1800 CONSULTANTS
to Help Solve Your Grinding Problems
THESE experienced representatives of Norton distributors work out of 150 cities.
Backed by a competent Norton field staff operating from over 25 industrial centers.
Backed by special field engineers—each an expert in a particular type of grinding.
Backed by extensive files of data on every type of grinding job.
This is Norton Consulting Engineering Service—an organization that can be depended on to solve your grinding problems.
NORTON COMPANY
WORCESTER, MASS.
New York
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Cleveland
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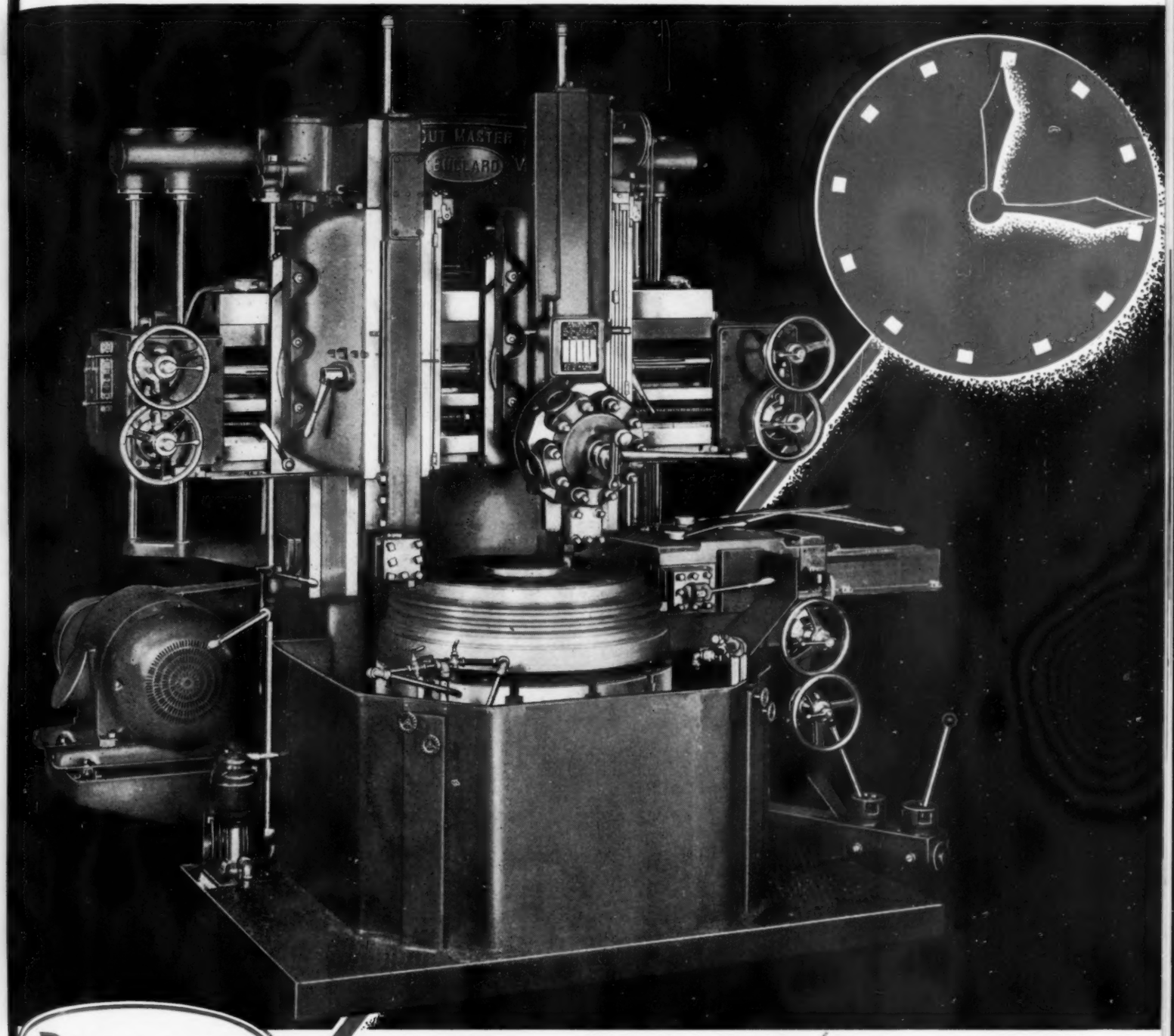
W-738
NORTON ABRASIVES

CUT MASTER



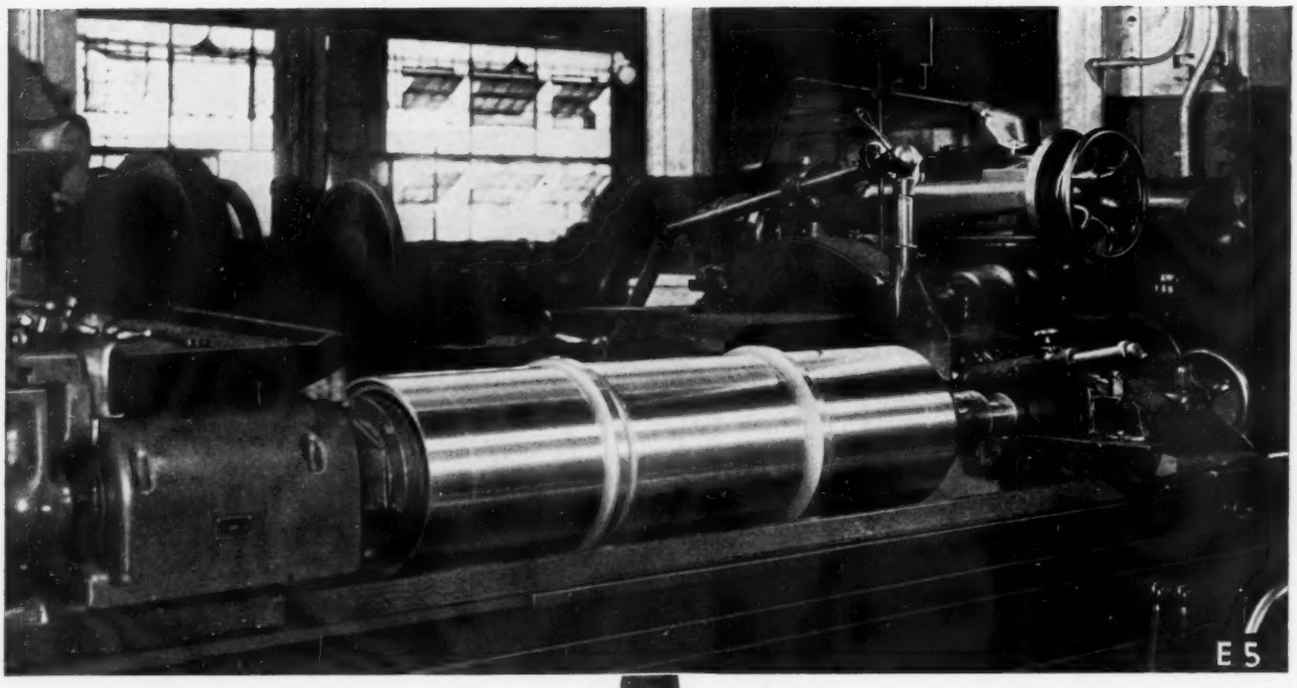
BULLARD

● Naturally, Cut Master is faster. Any two heads can be cutting while the third is being brought into position. And with rapid power traverse in all directions on all heads, you can save time between cuts, as easily as on cuts. However, if you can't use three heads, there are five other head combinations obtainable. Ask about these combinations.

Cut Master is something entirely new in Vertical Turret Lathes, in the speed and sustained accuracy of its operation. The "high points" given here are only a few of a great number, all contributing their part toward the quick acceptance of these new Vertical Turret Lathes. Send for the complete story, and be sure to tell us whether you are most interested in 30", 36," 42", 54", or 64" machines.

THE BULLARD COMPANY • BRIDGEPORT, CONNECTICUT

CUTS FASTER



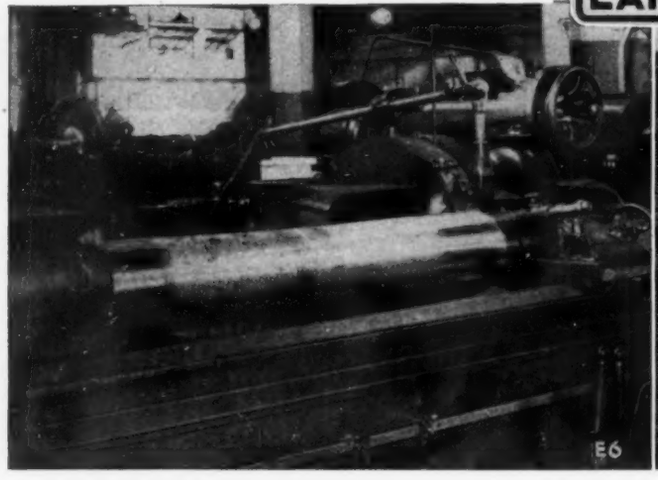
WORKING FOR THE RAILROAD

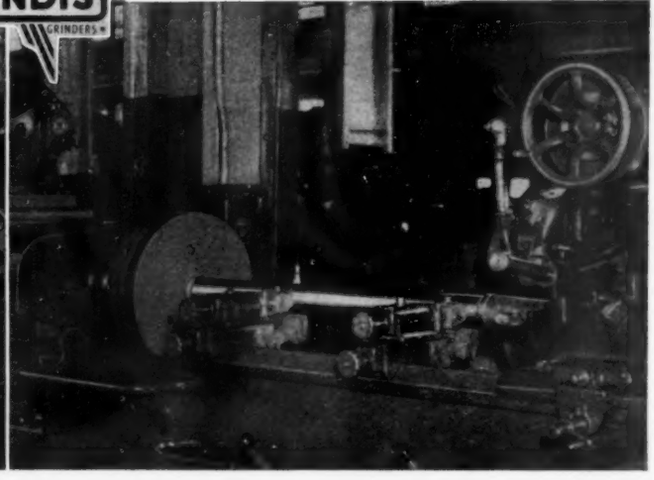
Landis Grinders over a long period of time have worked for the railroad. In the initial manufacture of such parts as axles, axle tubes, piston rods, valve yokes, and locomotive crank pins they have served well. It is quite logical that the same machines should be used in the reconditioning of these parts in railroad repair shops. Here, as never before, their speed and accuracy are helping in that fight to reduce cost.

Above is a Landis 16″ x 96″ Type B Plain Hydraulic grinding a locomotive axle tube. Below to the left is the same machine grinding a locomotive axle, while to the right below is a Landis 16″ x 96″ Type B Plain Hydraulic with gapped table grinding a piston rod.

If you manufacture or recondition railroad parts, modern Landis equipment should be put on your pay roll without delay. 260

LANDIS TOOL CO. WAYNESBORO, PA.

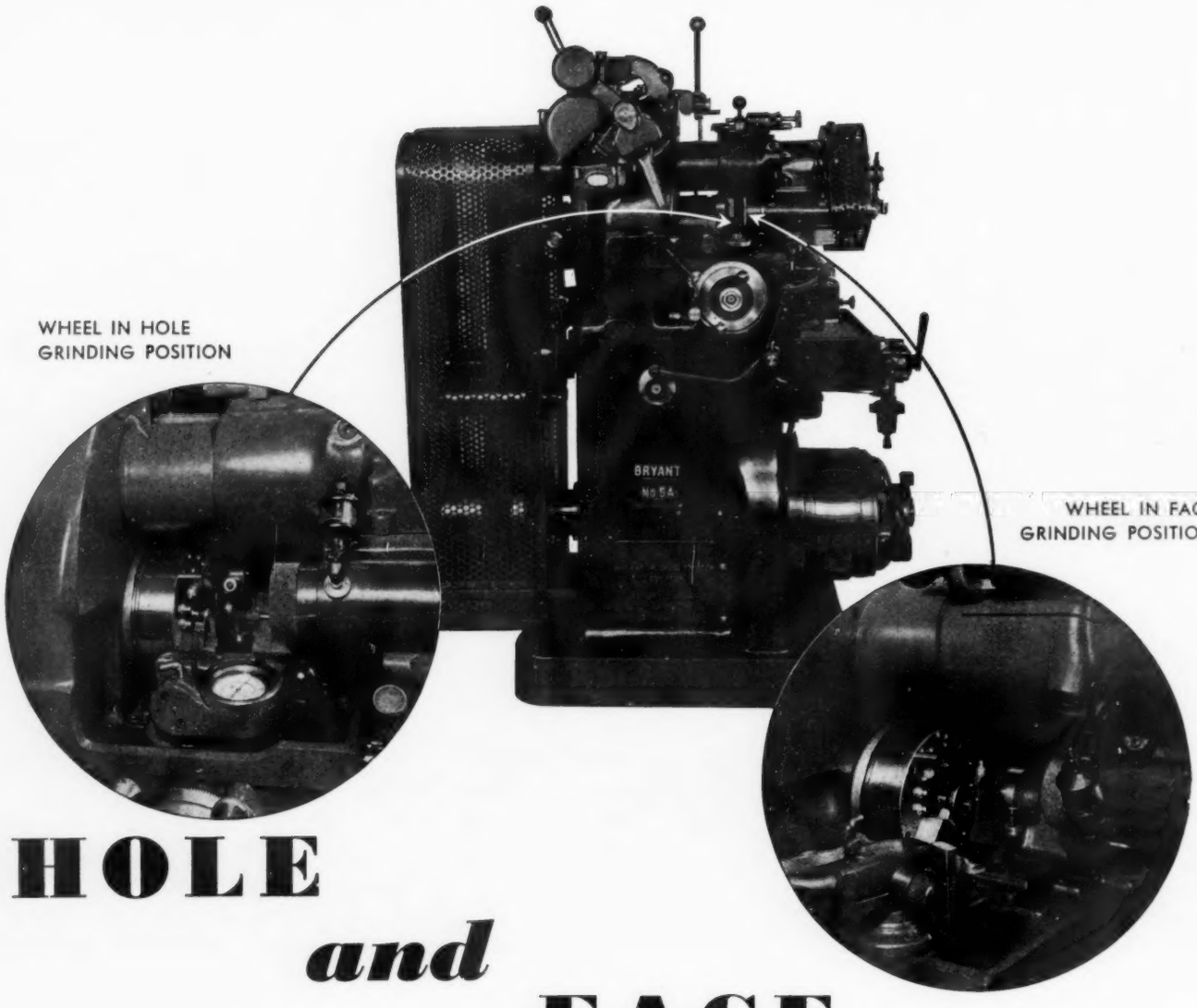




When Cannon Grow Cold

... war-skilled fingers will loosen their grip and reach hungrily for the instruments of peace. Weary men will catch their breath and think of production for consumption, not destruction. They will take their place beside marvelously improved machines which will help create a greater abundance of goods so necessary to the comfort, convenience and happiness of millions. The Monarch Machine Tool Company, Sidney, Ohio, U. S. A.

Monarch
Lathes



HOLE *and* FACE

IN ONE SETTING ON BRYANT GRINDERS

THE No. 5A Bryant Grinder is equipped with two grinding wheels — one for grinding the bore, and the other for grinding the face *concentric with the bore.* The No. 5A shown above is set up for grinding the hole and face on a steering gear part. This part is held in a sliding jaw chuck which clamps the work on the V-groove on the outside diameter. Both the hole and face are ground in *one setting* of the work.

Think of the advantages this machine offers to *you* on similar jobs — absolute squareness — no rehandling — ability to use right grade and grain of wheels for different surfaces — ability to use the proper wheel speeds for best finish and production.

Estimates on your own hole and face grinding jobs will be sent without obligation. Write today!

BRYANT CHUCKING GRINDER CO., Springfield, Vt., U. S. A.

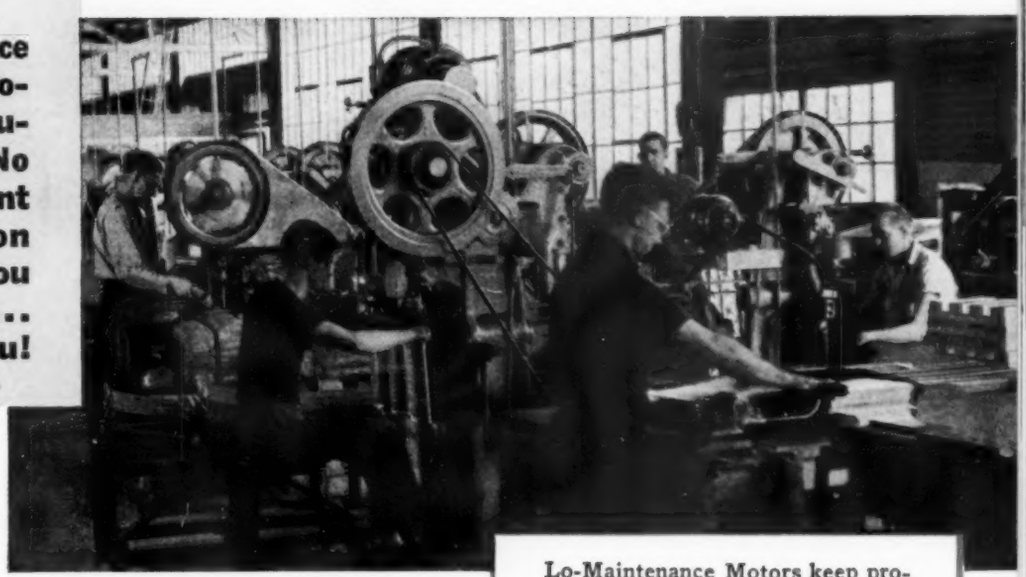
8½ YEAR REPAIR BILL

FOR 119 LO-MAINTENANCE MOTORS

$00.00!

Another true case history from the Allis-Chalmers files that proves **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**

Read the Sensational Performance Story of 119 Lo-Maintenance Motors . . . How They Ran Continuously for 8½ Years . . . With No Shut-Downs . . . and Not One Cent for Repairs! Get the Facts on the Full Measure Protection You Get with Allis-Chalmers Motors . . . on the Savings It Means To You!



Lo-Maintenance Motors keep production steady — without running up repair bills at the Lockwood Mfg. Co., Cincinnati, Ohio.

Here's a story that speaks for itself! And it strikes right home to every executive who is interested in keeping his production steady . . . in cutting costs in his plant!

When H. A. Lockwood, president of the Lockwood Mfg. Company of Cincinnati, bought 119 Allis-Chalmers Lo-Maintenance Motors, he knew from past experience that he was going to get good performance . . . but he never realized the amazing low-cost operating record those motors would set for him!

"We haven't spent one cent for repairs!"

"We feel," said Mr. Lockwood, whose company manufactures bakery pans and supplies, "that our motors are one of the most important parts of our production process. And you can readily see that for us motor failures are costly . . . in wasted operators' time . . . in production losses . . . in maintenance costs.

"That's why we are so enthusiastic about Allis-Chalmers motors. They've done everything you said they would do, and we haven't spent one cent for repairs on any of the 119 motors since we installed them 8½ years ago!"

That's why Mr. Lockwood ordered 33 additional Lo-Maintenance Motors to take care of expansion needs. And that's why in every industry . . . in plants throughout the country . . . plant managers are switching to Allis-Chalmers Lo-Maintenance motors! They know they get that extra margin of full measure protection that's built into every Allis-Chalmers Lo-Maintenance Motor.

Husky, all-around construction with no skimping on material . . . high carbon steel frame . . . indestructible rotor and distortionless stator . . . that's a combination that beats costly repair bills, eliminates time-wasting shut-downs!

Get the story of how Allis-Chalmers' 90 years of advancing with industry works for you when you buy a Lo-Maintenance Motor! Call the nearest District Office or write direct to Allis-Chalmers. Find out how you can cut costs . . . keep production steady with Lo-Maintenance Motors . . . the motors that give you more than just a rated horsepower! 1033

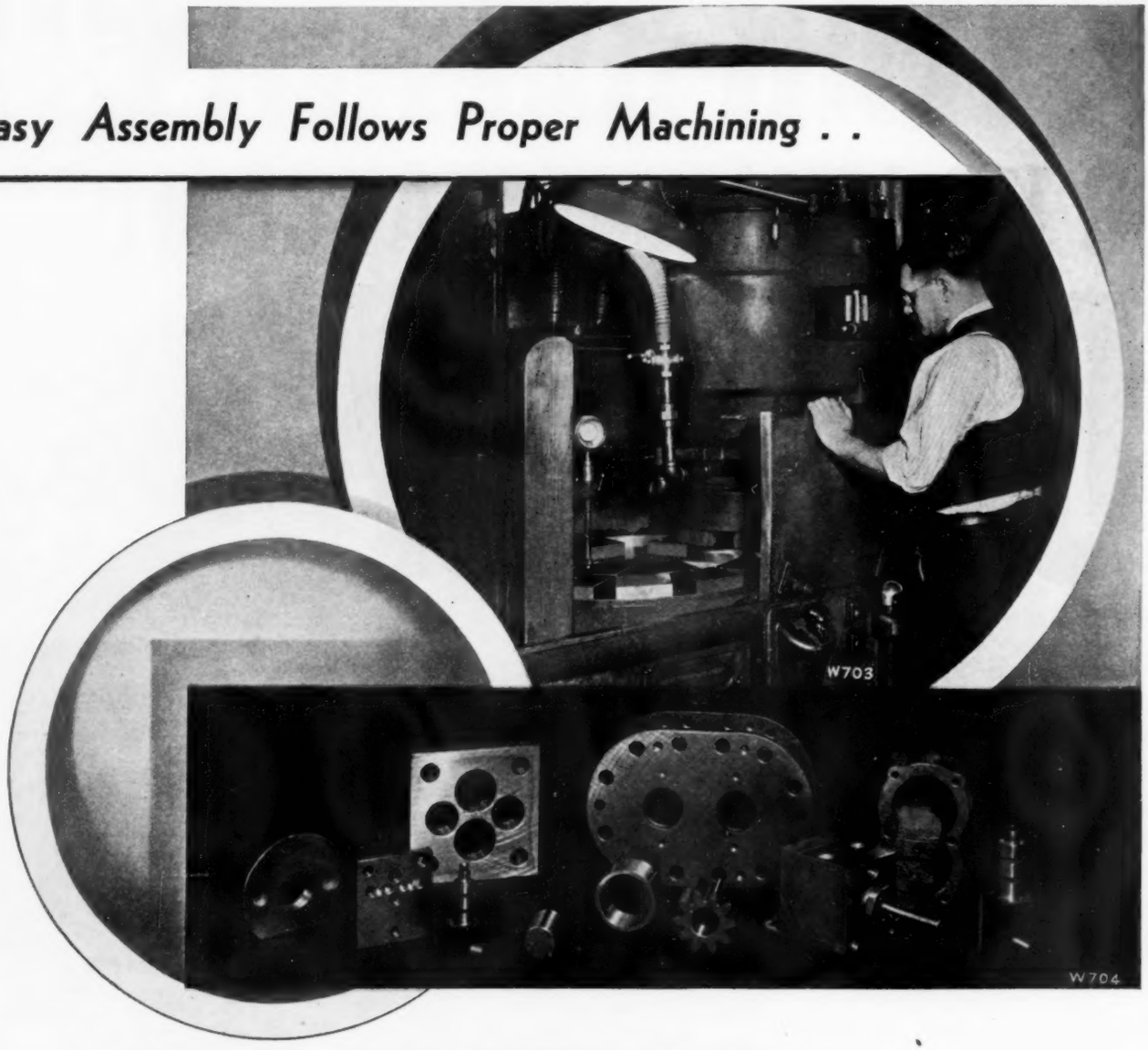
MOTORS FOR ALL APPLICATIONS FROM ½ HORSEPOWER AND UP

ELECTRICAL DIVISION

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

Easy Assembly Follows Proper Machining . .



FLAT SURFACE PARTS

finish ground for perfect alignment . .

The Blanchard method of surface grinding is your assurance that parts will be produced with an excellent finish, flat surfaces, and parallel sides — your assurance of perfect alignment for fast, easy assembly.

Many of the pump parts, shown above, are finished from the rough in one operation on the Blanchard No. 18. For instance, 1/32″ of stock is removed from both sides of the relief valve blocks at the rate of 66 pieces per hour. These plates are 5½ inches square. No further fitting, scraping, or filing is required on any of these parts before final assembly — and many of the joints must be water and oil tight.

Such accuracy and production means a wider margin of profit — a margin that will help beat the competition in your own field.

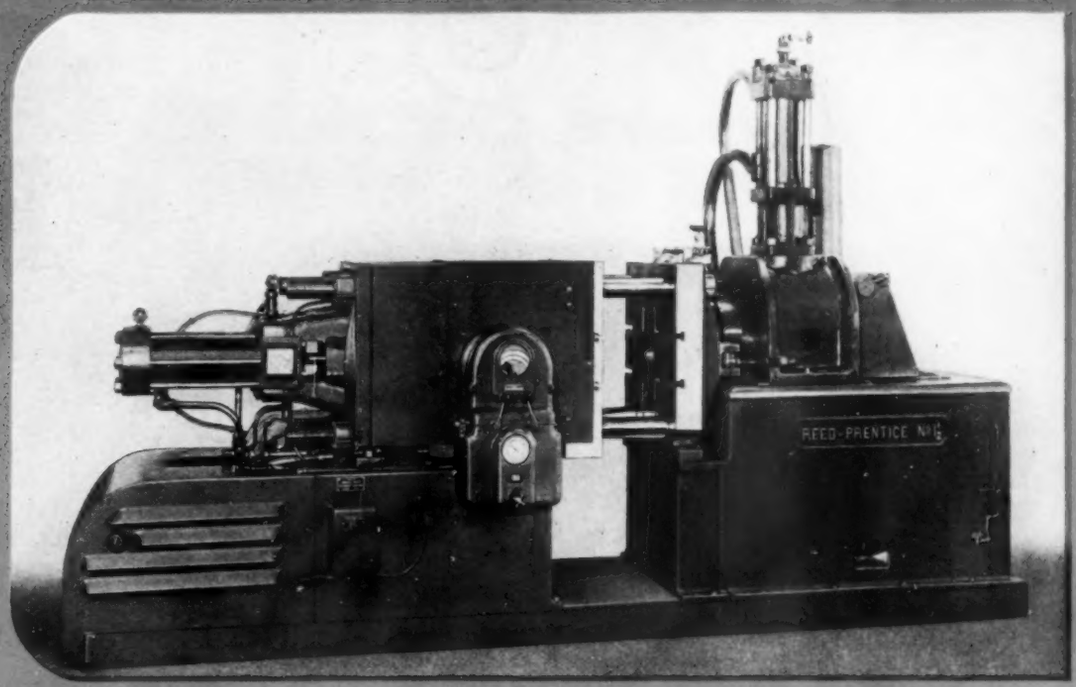
Accurate time studies and sample grinding are but part of Blanchard's service to the industry. Send us your samples or blueprints, there is no obligation.

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE, MASS., U.S.A.

SEND FOR YOUR FREE COPY OF THE BLANCHARD WORK BOOK

MODERN REED-PRENTICE DIE-CASTING MACHINES



NO. 1-1/2 FULL HYDRAULIC DIE CASTING MACHINE FOR ZINC, TIN OR LEAD BASE ALLOYS WITH SEMI-AUTOMATIC ELECTRIC CONTROL

Machine as shown is arranged for semi-automatic operation. It can also be furnished for manual operation. Available in two sizes.

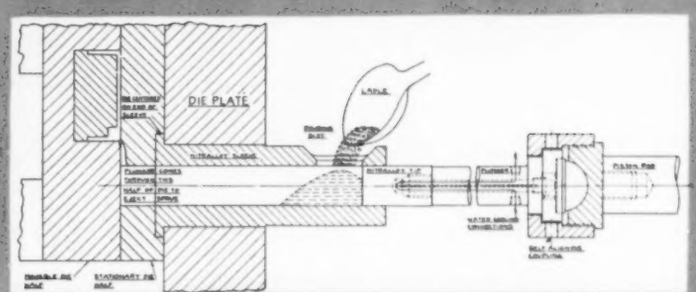
FEATURES:

•Fully hydraulic, with operations controlled by two levers, when manually operated, which are interlocked making it impossible to operate the plunger-cylinder until the dies are securely locked. •A safety pilot valve mechanism eliminates the danger of shooting the metal when the dies are open. •Dies provide for automatic ejection of castings. •Die plates are finished on all four sides to provide for core pulling attachments. In semi-automatic operation dies are closed manually after which cycle is controlled by automatic timing device.

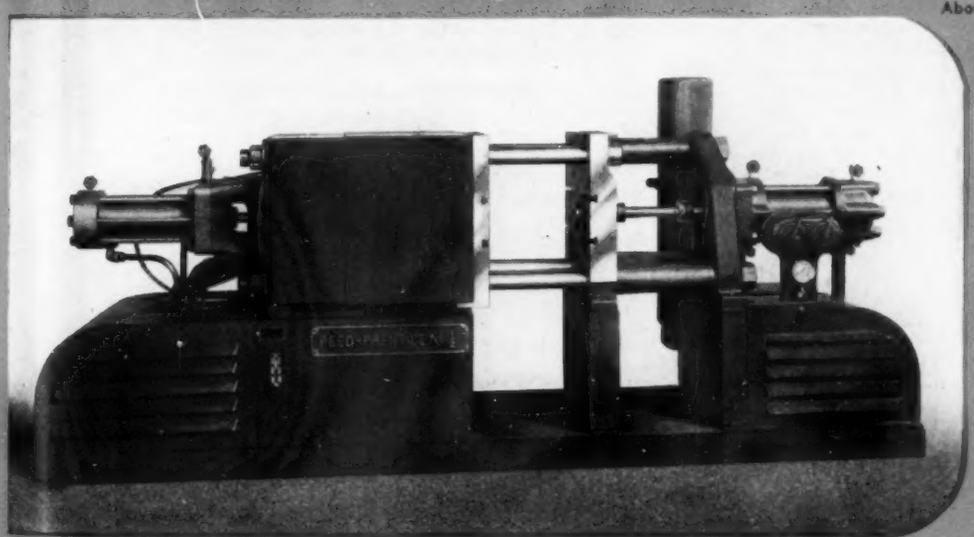
SPECIFICATIONS

	No. 1½	No. 2
Approximate size of die plates	28x29 in.	32x37 in.
Cap. of melting Pot (Zinc)	700 lbs.	900 lbs.
Space between bars	15x18 in.	18x21 in.
Die Opens	10 in.	12 in.
Maximum Die Space	18 in.	24 in.
Minimum Die Space	6 in.	8 in.
Locking pressure (Tons)	90	110
Weight	14300	16500

WRITE FOR COMPLETE DETAILS



Above line cut shows principle of operation, "G" type machine.



NO. 1½G HYDRAULIC HIGH PRESSURE DIE CASTING MACHINE — FOR ALUMINUM, BRASS, MAGNESIUM OR ZINC.

SPECIFICATIONS

	No. 1½G	No. 2G
Approximate size of die plates	28x29 in.	32x37 in.
Space between bars	15x18 in.	18x21 in.
Die opens	10 in.	12 in.
Max. Die Space	18 in.	24 in.
Min. Die Space	6 in.	8 in.
Locking Pressure (Tons)	90	110
Weight	11250	14100

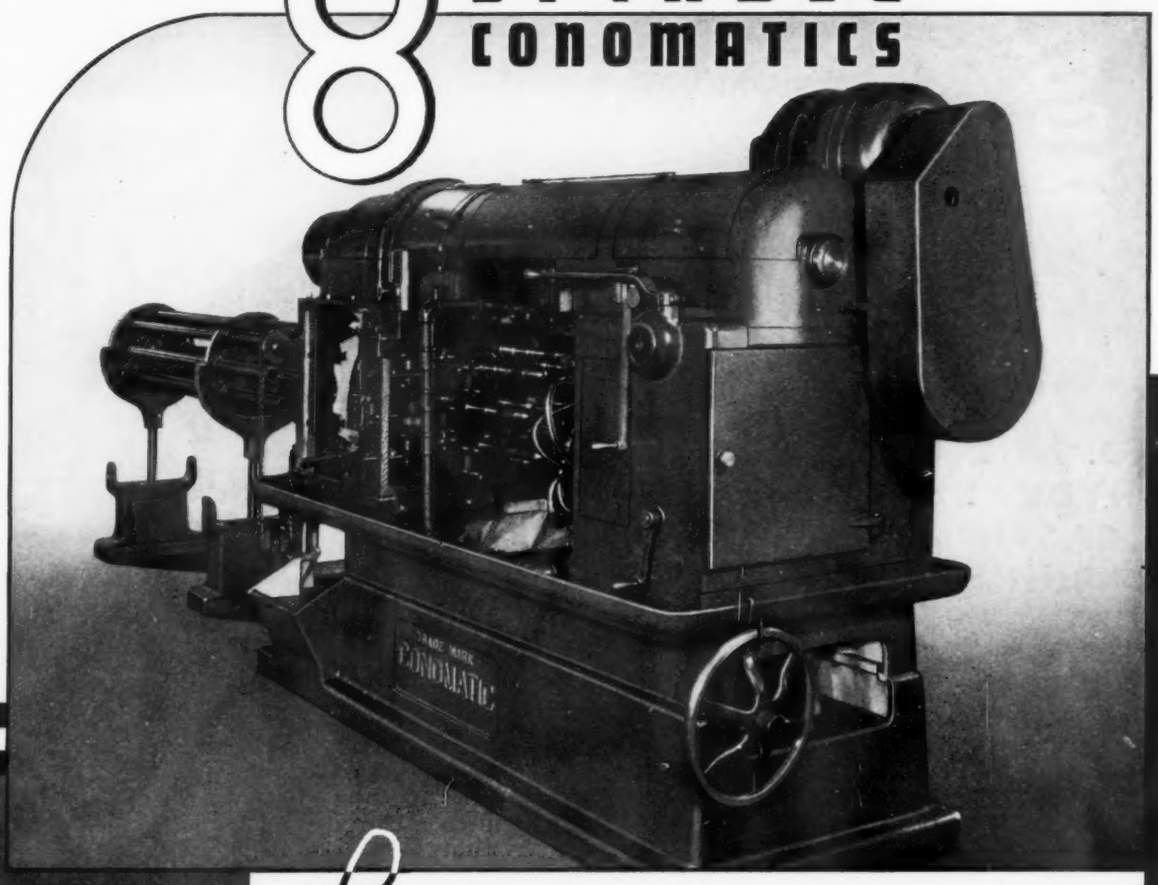
We solicit your die casting problems and offer a complete "Die Casting Service" including Machines, Dies, Design, for die cast parts in Zinc, Tin or Lead base alloys, Aluminum, Brass and Magnesium.

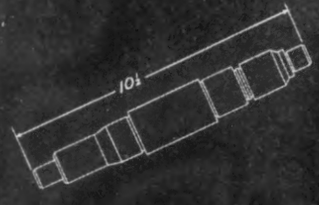
REED-PRENTICE CORP.

WORCESTER · · MASS., U. S. A.

DIE CASTING MACHINES
PLASTIC INJECTION MOLDING MACHINES
LATHES, ENGINE, TOOL ROOM, AND PRODUCTION
DIE SINKING MACHINES
VERTICAL MILLING MACHINES
JIG BORING MACHINES
SPECIAL PRODUCTION MACHINERY

8 SPINDLE CONOMATICS





8 SECONDS LESS THAN A MINUTE PER PIECE

A 1⅞" 8-spindle Conomatic is turning out these husky transmission shafts, one every 52 seconds. To be able to produce at a rate better than one a minute and maintain an accuracy to limits of .003" is a real achievement — but typically CONOMATIC.

Beating time estimates means

EXTRA PROFITS

BEFORE any CONOMATIC is recommended for a job, preliminary time studies by Cone engineers, *figuring most conservatively*, must show substantial savings.

That is why, when an 8-spindle CONOMATIC is prescribed and put to work, investment dollars are almost invariably returned at a rate faster than time estimates originally anticipated. Quicker dividends and extra profits are plus benefits offered by these exceptionally rigid, heavy cutting, highly accurate automatic screw machines. *We can base these estimates accurately on Cone 8-spindle performance over the past ten years.*

In quality of finish, productivity, accessibility and adaptability, the 8-spindle Conomatic is outstanding in its field. High productivity in handling multiple operation work on bar stock and low tool costs make CONOMATICS extremely efficient and economical. Made in five sizes with capacities for handling round stock as follows: 1¼, 1½, 1⅞, 2¼ and 2⅝ inches.

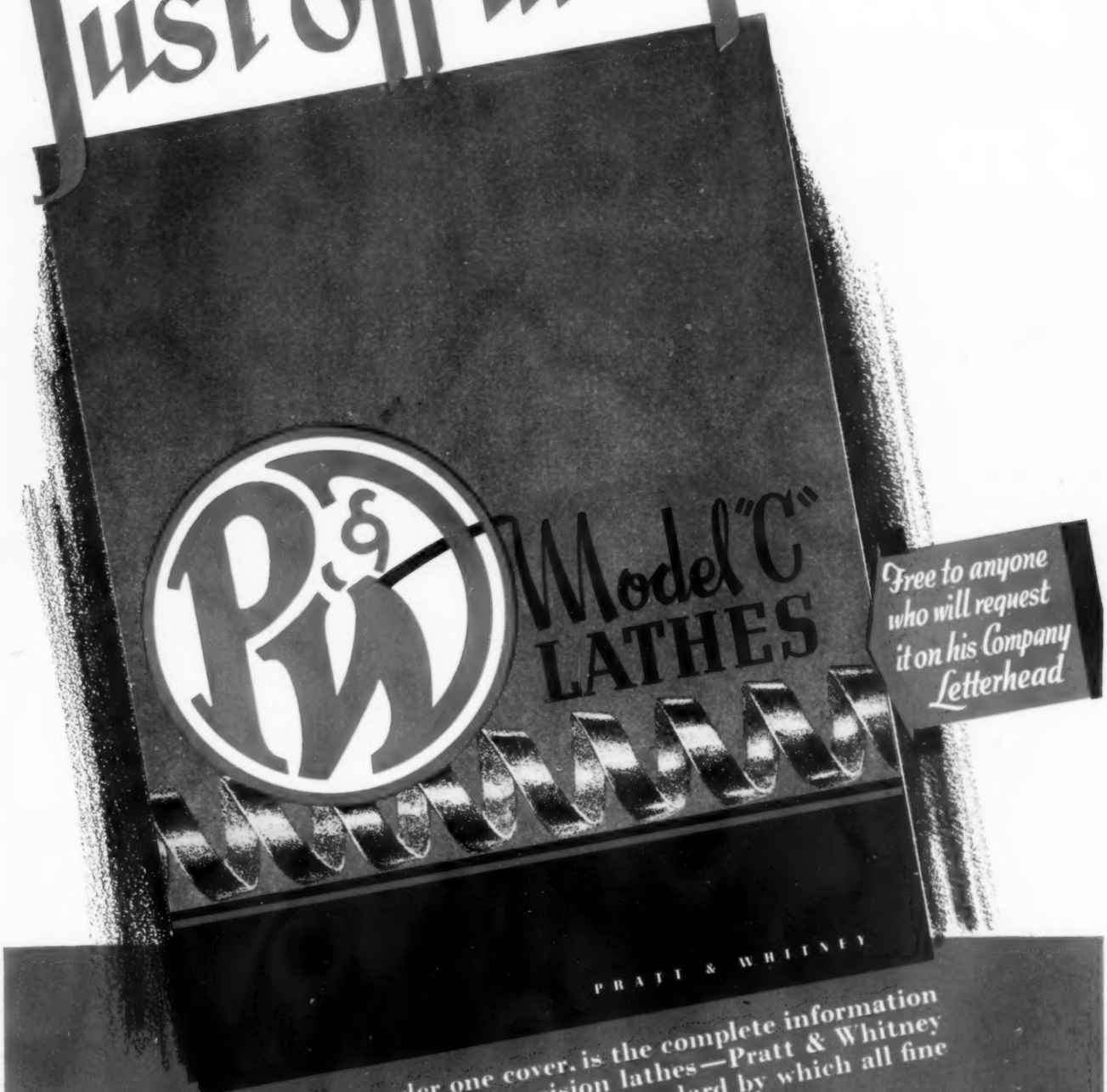
Ask Cone engineers to make a conservative estimate on the time savings available on your work.

There's a Cone Automatic that will help you to EXTRA PROFITS. Write for catalogs covering the complete line.

CONE AUTOMATIC MACHINE COMPANY

WINDSOR VERMONT, U. S. A.

Just off the Press!



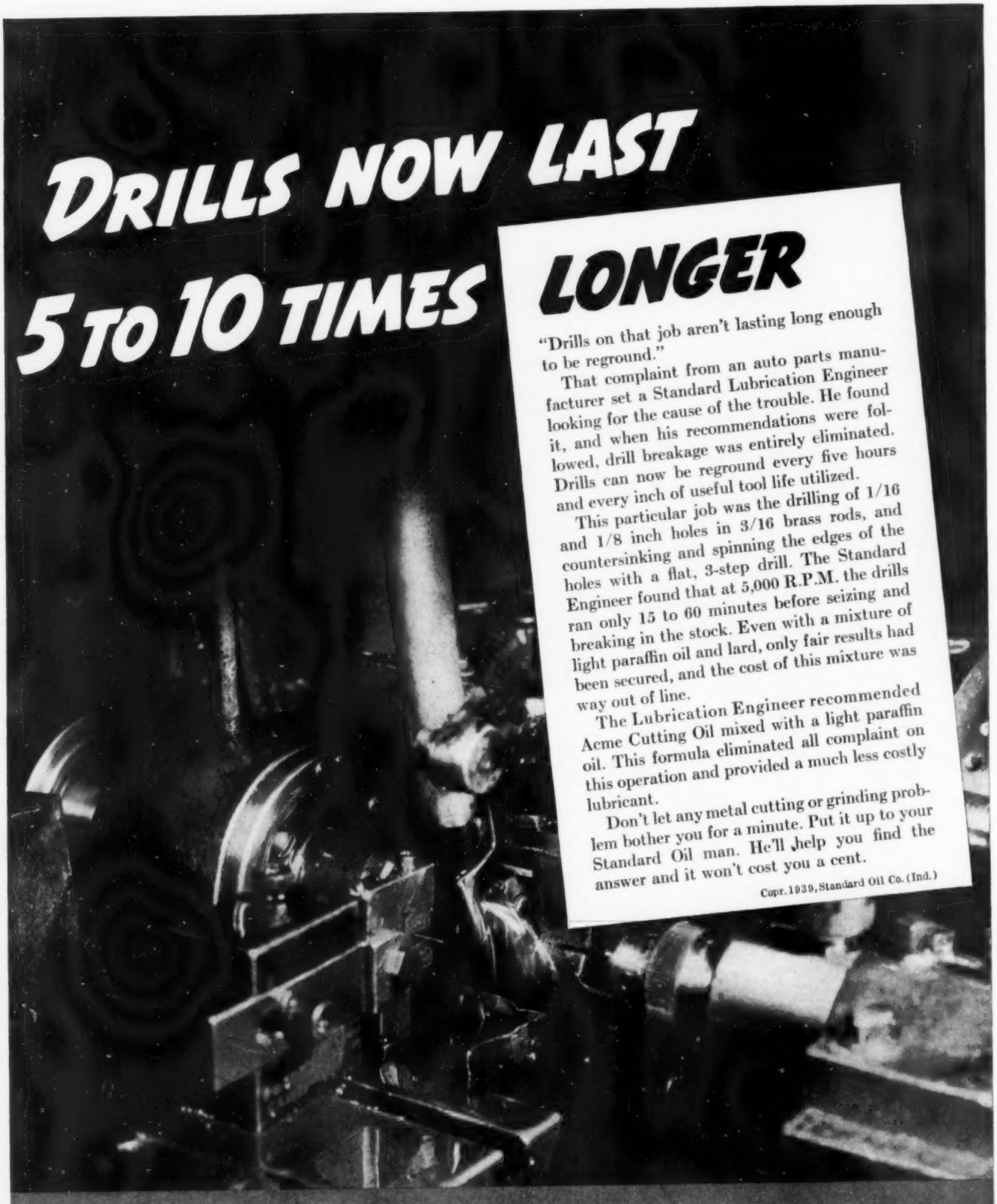
Free to anyone who will request it on his Company Letterhead

Here, under one cover, is the complete information you wanted on precision lathes—Pratt & Whitney Model "C" Lathes—the standard by which all fine lathes are judged. Write for it today.

PRATT & WHITNEY

Division Niles-Bement-Pond Co. HARTFORD, CONN.

DRILLS NOW LAST 5 TO 10 TIMES LONGER



"Drills on that job aren't lasting long enough to be reground."

That complaint from an auto parts manufacturer set a Standard Lubrication Engineer looking for the cause of the trouble. He found it, and when his recommendations were followed, drill breakage was entirely eliminated. Drills can now be reground every five hours and every inch of useful tool life utilized.

This particular job was the drilling of 1/16 and 1/8 inch holes in 3/16 brass rods, and countersinking and spinning the edges of the holes with a flat, 3-step drill. The Standard Engineer found that at 5,000 R.P.M. the drills ran only 15 to 60 minutes before seizing and breaking in the stock. Even with a mixture of light paraffin oil and lard, only fair results had been secured, and the cost of this mixture was way out of line.

The Lubrication Engineer recommended Acme Cutting Oil mixed with a light paraffin oil. This formula eliminated all complaint on this operation and provided a much less costly lubricant.

Don't let any metal cutting or grinding problem bother you for a minute. Put it up to your Standard Oil man. He'll help you find the answer and it won't cost you a cent.

Copr. 1939, Standard Oil Co. (Ind.)

FIRST IN SERVICE
FOR FIFTY YEARS
STANDARD OIL (IND.)

STANDARD OIL COMPANY
(INDIANA)

FASTER PRECISION GRINDING

with Continued Accuracy

YOU CAN obtain faster, uniformly accurate grinding, like that required in the automotive industry for crankshaft bearings, with Bakelite Resinoid Bonded Abrasive Wheels. Tougher, stronger, these wheels cut more freely, wear more evenly. With grinding speeds from 6000 s.f.p.m. to 9500 s.f.p.m. they increase production of precision jobs, yet assure continued accuracy. Write for further information contained in our illustrated booklet 14G, "High Speed Abrasive Wheels".

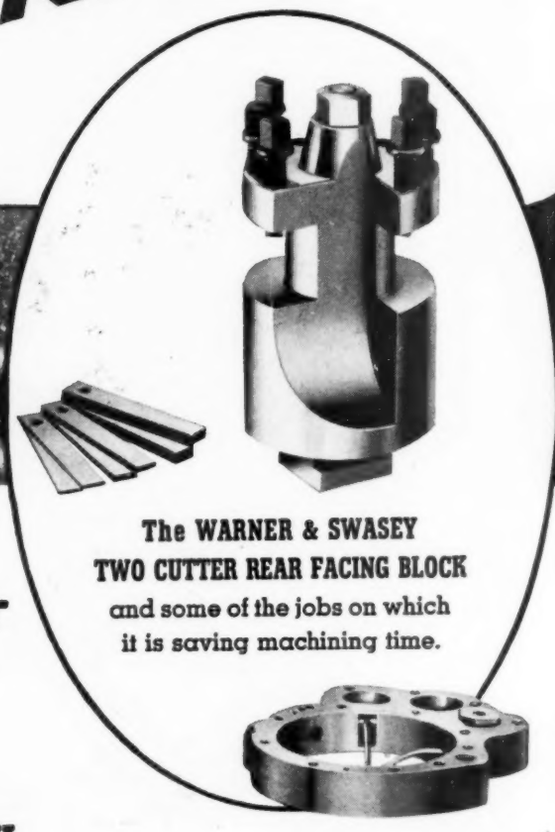
BAKELITE CORPORATION, 247 PARK AVENUE, NEW YORK, N.Y.
CHICAGO: 43 East Ohio Street. BAKELITE CORPORATION OF CANADA, LTD., 163 Dufferin Street, Toronto, Ont.
West Coast..Electrical Specialty Co., Inc., Los Angeles, San Francisco and Seattle

BAKELITE

The registered trade marks shown above distinguish materials manufactured by Bakelite Corporation. Under the capital "B" in the numerical sign for infinity, or unlimited quantity, it symbolizes the infinite number of present and future uses of Bakelite Corporation's products.

BONDED WHEELS

Taking Two Facing Cuts with ONE PASS *of the* CROSS SLIDE



The WARNER & SWASEY TWO CUTTER REAR FACING BLOCK and some of the jobs on which it is saving machining time.

13% Time Saving

USING THE NEW

WARNER & SWASEY

TWO CUTTER REAR FACING BLOCK

Chandler and Evans manufacture aircraft carburetors and fuel pumps at Meriden, Connecticut. These accurate high speed chucking jobs, illustrated here, formerly required two facing cuts from the cross-slide. With the new Warner & Swasey Two Cutter Rear Facing Block, two facing cutters can be held in a wide range of positions for simultaneous facing operations... saving time and machining accurate shoulder lengths without depending upon machine stops.

You'll find a complete description of this new tool on page 100 of the new Warner & Swasey Tool Catalog and Manual. Have you your copy? For prices, or further information just write Warner & Swasey Company, Cleveland, Ohio.

WARNER & SWASEY
Turret Lathes
Cleveland

YOU CAN TURN IT FASTER, MORE ACCURATELY FOR LESS . . . WITH WARNER & SWASEY TOO

WHAT'S IN THIS ISSUE

MAINTENANCE of railroad equipment is as old as railroading itself. So is much of the equipment used for the purpose. Not so with the Mexican National Railway, however. In its shops the value of new machine tools has long been recognized, resulting in a policy of replacement which will continue in the future. Fred Colvin tells about it on page 1076.

PRESS FORMING a casting is an unusual production operation. But the Japanese, exceedingly clever, are using the process with considerable success. On page 1074 are the details, as reported by Herbert M. Darling.

DIAMONDS have their place in industry, too. Some diamond cutting tools, for example, can finish 200,000 pieces before relapping is necessary. But just any old diamonds won't do. They're selected, cut and mounted as carefully as if they were going to adorn the wrist of a society matron. The hows and whys are given on page 1071.

PRACTICAL MEN are always finding better ways to do things. On page 1086 several tell how they've done some hard things the easy way. Their workable suggestions are illustrated with drawings, sketches and photographs.

DOUBLE SLINGS won't lift twice as much as single ones—the angle of separation reduces their carrying capacity considerably. Safe loads for many sizes of slings, used at various angles of separation, are included in the Reference Book Sheet on page 1089.

INSPECTION is an important job which can cost a lot if you're not careful. On page 1084 L. A. Corey tells how costs can be kept low and quality high by using dial indicators applied to ingenious fixtures.

LT. COL. E. E. MacMORLAND

PRECISION has long been an old story. But it wasn't always so. Time was when a sixty-fourth was a close tolerance, when every part of a fine mechanism was individually finished and fitted by hand. Then along came a certain Capt. John H. Hall, who had an idea about interchangeability. His work marked the beginning of a new era in metal-working. On page 1078 Lt. Col. E. E. MacMorland recounts Capt. Hall's early work on interchangeable rifle parts.

CHROMIUM PLATING is rapidly coming into its own as a process for making metal parts useful as well as ornamental. Plastics, for instance, have little abrasive action on a chromium-plated die. Better still, they won't stick to it! Plenty of pictures of various applications making use of this fact are shown by Edwin Smith on page 1072.

EDWIN SMITH

GEARS can be noisy for many reasons. And noisy gears are imperfect gears. It takes close control of every production process to make them quiet. How one company, making thousands of precision gears destined for severe service, manages to do it is told by R. R. Wiese, beginning on page 1067.

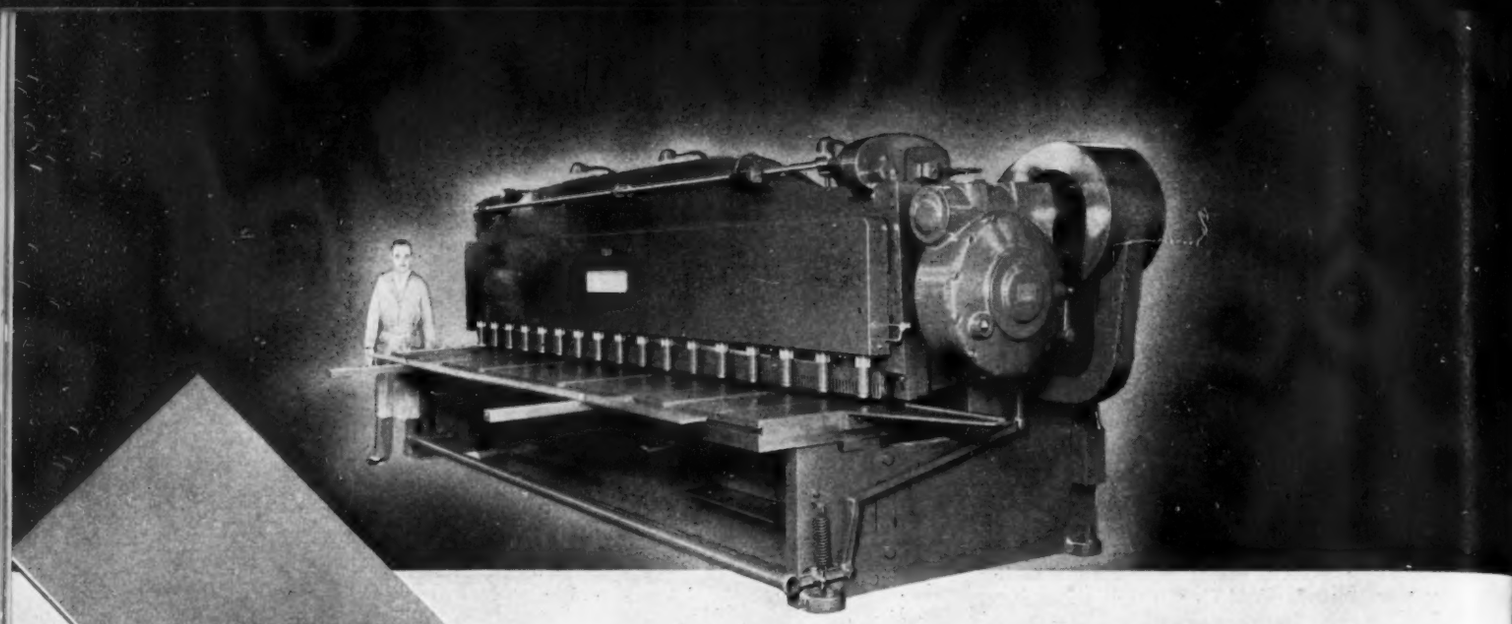
SHORT CUTS are always welcomed by shop men. On page 1083 A. H. Waychoff presents another batch of handy kinks especially useful in small shops.

LABOR BOARD activities are always news. But now it's being investigated by a Congressional committee in an effort to find out just what's what. Is it on the spot? Is it guilty of prejudice? Has it helped the cause of labor? Latest developments are on page 1090c.

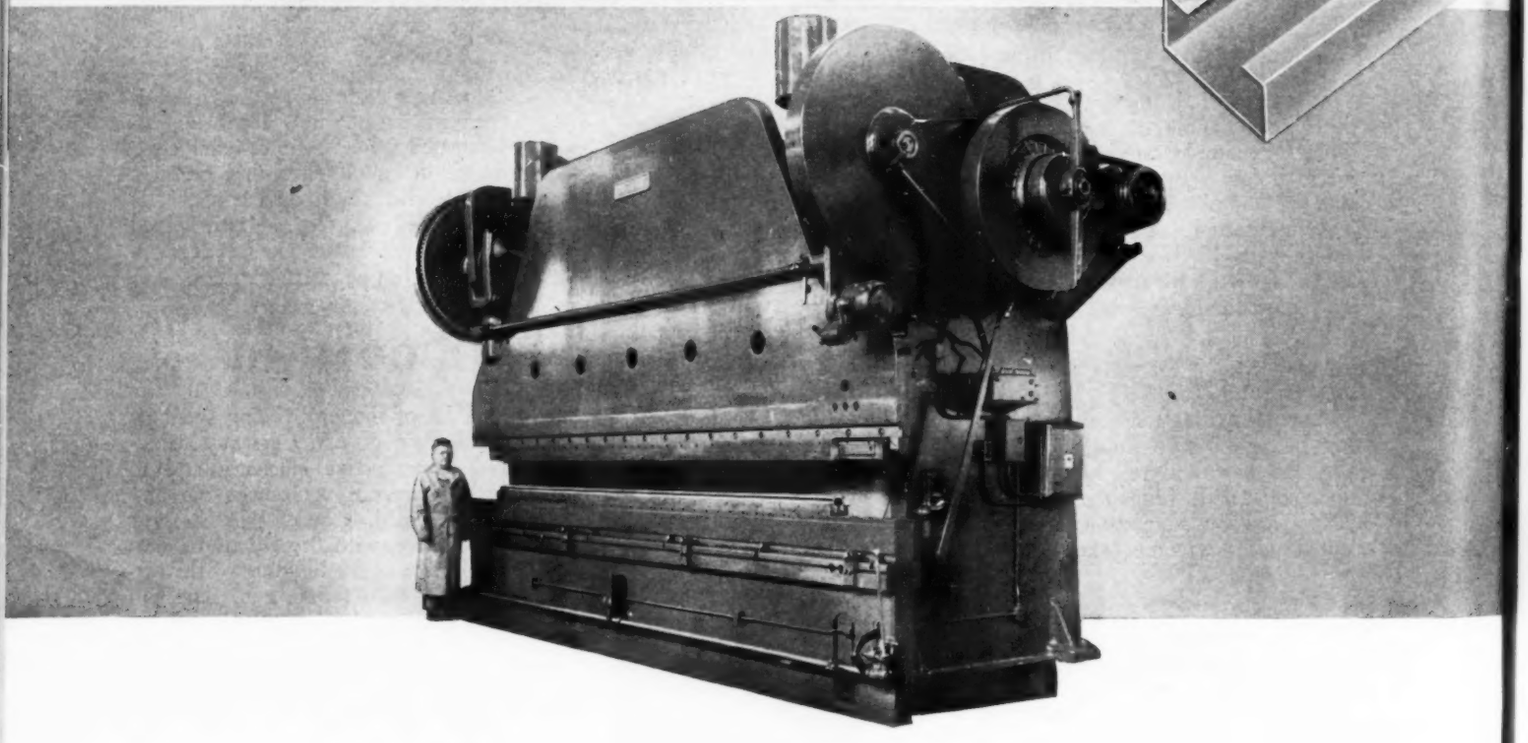
COMING

A lot of money is being spent by Uncle Sam at Army arsenals to increase productive efficiency and to make ordnance equipment the best in the world. One of the jobs now done there, with the aid of modern machinery, is the building of the carriage for the 75 mm. gun. The gun and recoil mechanism of this unit are mounted on a sub-carriage, with a trunion placed further aft to allow more elevation, the former single trail having been replaced by a split trail. A great deal of welding is noted in the new carriage. In a leading article in a coming issue we shall tell our readers exactly how this carriage is made. Many excellent pictures will help to make the process easily understood.

The foreman has many duties—to help select the men to work under him, to handle grievances, to keep men interested in their jobs. An article in an early issue will give him some good tips about these tasks.



ACCURATE SHEARING ACCURATE FORMING

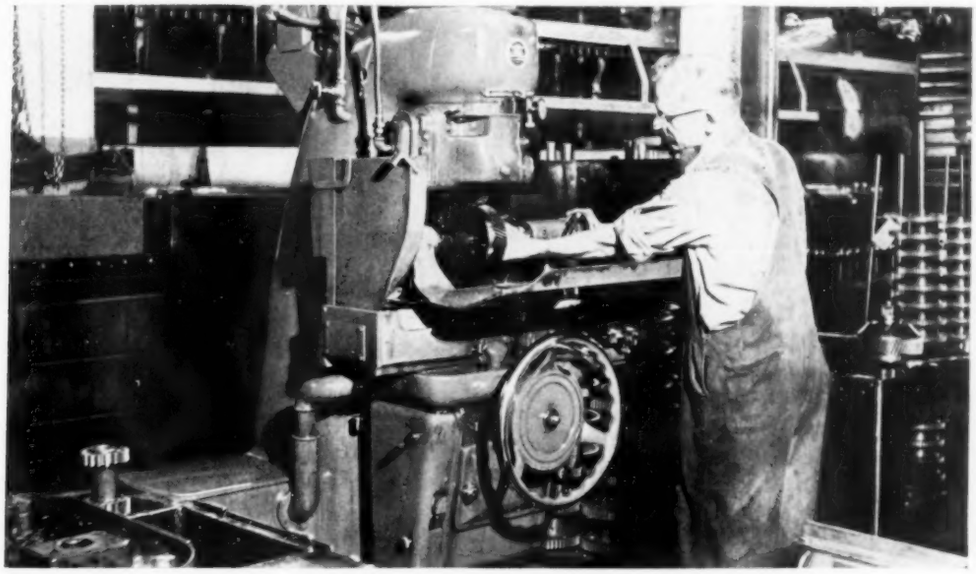


Parts just naturally go together • • • • •
when sheared on a Cincinnati All-Steel
Shear • • • • • or formed on a Cincinnati
All-Steel Press Brake. • • • • • • • • • •

THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO

SHAPERS · SHEARS · BRAKES

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor



Both rack- and rotary-type shavers are used for finishing spur and helical gears. Kerosene tanks are kept at each machine for cleaning finished gears before inspection

Noisy Gears Are Out

International Harvester keeps gears up to standard, and quiet, by close control of production processes

By R. R. WIESE
Western Editor, American Machinist

NOISY GEARS cannot be tolerated in the modern tractor. That is why International Harvester has instituted complete laboratory control of material selection, gear production processes and heat-treatment at its Milwaukee plant. Some 30,000 gears, including those for its new small "Farmall" tractors built at Rock Island, are turned out every week.

Not only do noisy gears have a disagreeable effect on the operator, but noise is an indication of gear trouble in the making. Tractor gears operate under almost full-power loads for such a large percentage of the time that nicks, cracks, tool marks and other defects—all of which help create noise—eventually cause fatigue failure. Misalignment of parts because of poor machining or poor matching also results in noise. It causes concentration of loads on small tooth areas with a consequent increase in the chance for gear failure.

The trend toward small, fast tractors not only has emphasized the need for well-made gears, but also has increased the demands on the materials from which the gears are made. High alloy steels are being used to withstand the heavy loads on gear teeth; momentary crushing loads as high as 250,000 to 300,000 lb. per sq.in. have been reported in some cases.

Methods of manufacture and the correlation of various departments to meet these production requirements are indicated briefly in the accompanying table, which lists operations in the different departments for drive bevel gears and reverse idler gears. Factors of quality which each of the departments control are given below.

GEAR LABORATORY — This laboratory insures that the best possible production methods are used to achieve the required quiet operation of gears. It has jurisdiction over speed tests of bevel gears, speed tests of spur gears in the "quiet" room, final speed tests for gear matching and, most important, a control of all gear dimensions through control of gear cutting setups and operations.

The following standards are established by the laboratory in pre-production tests:

1. All gear blank faces must be at 90 deg. with bore and parallel within 0.001 in. Every blank is inspected to insure accuracy.

2. When hobbing machines are set up the arbors must run within 0.0003 in. The hob spindle must run within 0.0003 in. as determined by checking

the hubs of the hob. Bushings and arbors are made 0.0003 in. below the low limit of the bore. Gear teeth are semi-finished in one hobbing cut. The same procedure is followed on spur gear shapers except that blanks are rough cut and then semi-finished once around. Block gages are used to control the semifinished size at the machine.

3. Gears then are brought to the gear laboratory to check size, lead of tooth and accuracy of profile by involute measurements on Illinois machines. Accuracy of pitch line concentricity and face run-out is checked to be sure teeth are cut in correct plane. In semi-finishing the following standards are held: Lead error, 0.0003 in. per inch of tooth face; pitch line run-out, 0.002 in.; faces must run within prescribed limits on checking fixture; tooth spacing is held within 0.0006 in. accumulated error in 180 deg.; involute normally is held plus or minus 0.003 in. There are exceptions in which sufficient sweep is allowed in the root radius for shaving cutters when a maximum tolerance of +0.0005 in. is allowed within the active profile. Allowance on actual tooth thickness for shaving is 0.002 in. When the first gears have passed these tests the gear cutting set-ups are approved for production runs.

4. The operator of the shaving machines checks the lead on the first piece cut on the shaving arbor, after which the first piece is checked in the gear laboratory.

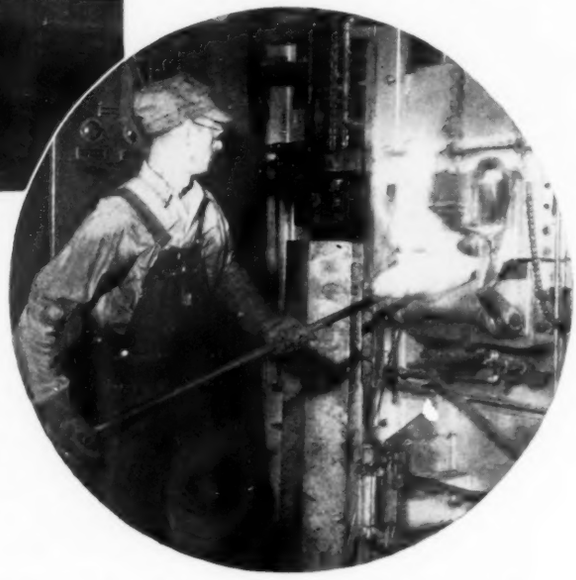
5. Laboratory technician mounts the piece on a straight arbor and bushing and checks the lead, pitch line run-out, face run-out, tooth spacing and involute on an Illinois machine. The lead must be within 0.001 in., pitch line within 0.001 in., faces within limits, and spacing within 0.004 in. accumulated error in 180 deg. The involute must check ±0.002 in. within active profile.

6. Gear is speeded in the "silent" room for sound test, the gear must run smooth with no perceptible rattle or clatter and without objectionable sing. When the gear has passed this test satisfactorily the shaver is ready to operate in production.

After production is under way gear laboratory duties include:

1. Periodic checks are made in the gear laboratory to insure accuracy of the product throughout the production schedule.

All spur gears are lapped prior to final speed testing and matching. Red Line speeders show up noisy gears



Bevel gears are unloaded from the gas-fired furnace by hand and transferred to Gregg-Logan quenching machines

2. After shaving, production gears are sent into the "silent" room on a roller conveyor and checked 100 per cent on the speeding fixture mounted on proper center distances. Gears then are hung on the overhead conveyor ready for the washer and heat-treatment.

3. After heat-treatment production gears are tested for file hardness, then spur gears are tested against masters in Brown & Sharpe machines with a maximum of 0.003 in. pitch line run-out permitted. Gears then are lapped, speeded and matched ready for packing. Bevel gears are speeded and matched ready for shipment.

MATERIALS AND TESTING—With increasing speed and power demands on tractors the strength of the gears has had to be increased in direct proportion. Higher alloy steels—S.A.E. 3115, 4120, and 4620—are replacing lower alloys, such as S.A.E. 1015, 1500 and 2300 grades. All are carburized except the bull gears, which are of oil-hardening S.A.E. 3147 or 4145 steel. The metallurgical laboratory checks the quality of the steel before it is accepted and stored in the forge shop, samples selected at random being given a chemical analysis and a McQuaid-Ehn grain size test.

It has been found that tensile tests are not required to secure satisfactory gears. The chemical analysis and grain size check is sufficient to predict whether the tensile values will be satisfactory. After heat-treatment gears are selected at random and several of the teeth loaded in a testing machine, using a fixture which applies the load on the active area of the teeth.

Forge shop practices are partially under the control of the metallurgical laboratory. The temperature of the billets, the number of hammer blows and the size of the hammer are under observation by a representative of the laboratory who acts as a roving inspector in the forge shop. This inspector is equipped with an optical pyrometer with which to make periodic checks of the furnace and billet temperatures. The usual temperature of the billet is 2,100 to 2,200 F. The

forging normalizing furnace operation also is controlled by the metallurgical laboratory.

All gears are heat-treated according to instruction cards issued by the metallurgical laboratory based on a series of pre-production tests. It has been found that the action of the carburizing furnaces best can be checked by pieces having square edges, not by the usual round bar test pieces. Bars about $\frac{1}{4}$ in. square are used to determine the concentration of carbides at the sharp corners. Round bars, 6 in. in diameter, also are put through the furnace at intervals. These are ground down in four steps of 0.005 in. each to check hardness penetration.

FORGE SHOP—After it has been approved by the metallurgical laboratory, steel stock is stored along one bay of the forge shop. Shears and saws for cutting the billets and the flat stock are placed at the end of this bay. The shears are used for the low carbon stock and the saws for cutting the higher carbon steel. Most of the gears are made by the up-setting process. The bevel gears, however, are forged from flat stock.

In addition to checking temperatures of billets, the roving inspector from the Metallurgical Laboratory also checks to see that the proper steels are being used and that the number of hammer blows required to shape the blanks is correct for best results. The proper number of blows for the various shapes are determined in pre-production tests. When the number of blows used in production is appreciably less than standard (indicating that the temperatures are too high for best plastic flow), or is appreciably more (indicating the temperature is too low and metal is too hard for best flow) the inspector corrects the situation.

After forging, the blanks are normalized in a gas-fired furnace, built by the Electric Furnace Company. Blanks are loaded in trays which are lifted from the tote box level to the furnace opening by an hydraulic elevator, from where they move on to the roller conveyor inside the U-shaped muffle. The gears are heated to about 1,725 F. in the first "leg" of the furnace. Electric limit switches actuated by the moving trays at the end of the heating zone cause hydraulic pushers to move the trays across the end of the furnace. In this section the temperature is dropped rapidly through the critical temperature to about 1,200 F. Another pusher moves the trays into the cooling zone, which is along the other "leg" of the U-shaped furnace. On this conveyor they are re-heated to about 1,350 F. and gradually cooled as they travel to the end of the furnace and out on the elevator. This cycle annealer has the effect of "spheroidizing" the forgings.

GEAR BLANKING — Typical operations in the gear blanking department are shown in the accompanying table. All work is held to fairly close limits and inspection is such as to insure that only good blanks are shipped out of this department. It has been found that the spoilage which was being blamed on heat-treatment was usually due to errors in manufacturing or in material. The gear laboratory, upon careful investigation, has determined that once a satisfactory heat-treating procedure was set-up the majority of spoilage can be traced back to imperfect forging, blanking or cutting, and only occasionally to the heat-treating process.

"Green" broaching of splines has replaced boring and reaming operations on gear blanks. Broaching the splines at an early stage of gear manufacture permits the use of arbors for succeeding cutting operations with consequent improvement in accuracy and a decrease in the amount of run-out.

GEAR CUTTING DEPARTMENT—The procedures given in the table outlines in a general way the activities of the gear cutting department. Some important factors in the production of quiet running gears include:

1. Gears which are climb-hobbed have been found to result in a final product which is quicter than that obtained by normal hobbing operations.

2. All set-ups in the shapers and hobbing machines are checked for tooth form by the gear laboratory. After the laboratory has approved the first gear the set-up is permitted to go into regular production. Every time a hob is changed the tooth form again is checked before production can proceed. Set-ups in the shavers also are checked.

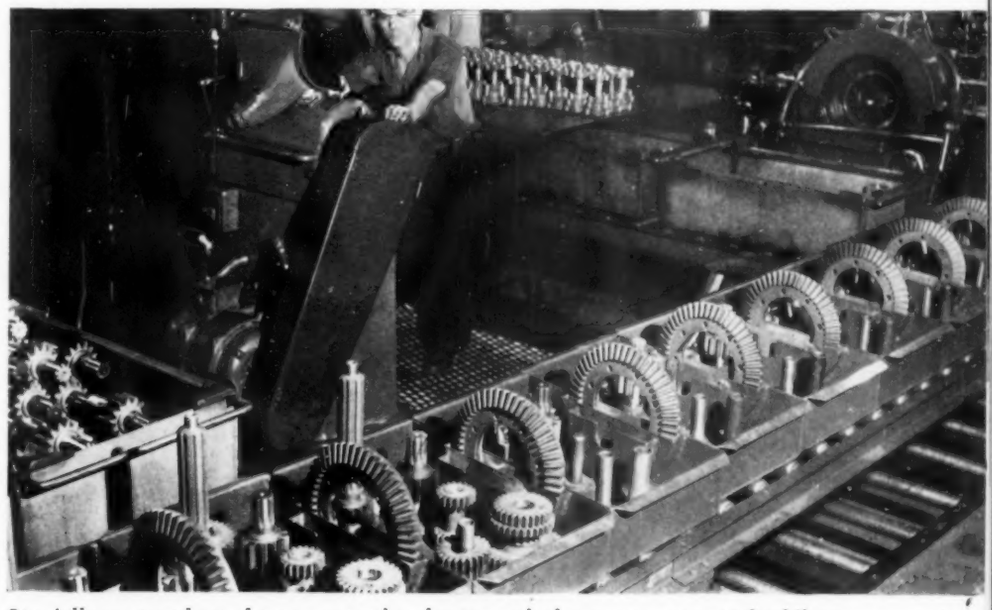
3. Generally bevel and step gears are machined in a roughing and a finishing cut, while single spur gears are machined in one cut. Class A hobs are used in many cases to rough and finish in one cut. A slight negative break at the tip and at the root is permitted for most satisfactory clearance.

4. The large bull gears are climb-cut in groups of three to seven depending upon their face width. A rough and a finish cut are used.

5. Gear tooth edges are chamfered and rounded prior to the finish cutting operation wherever possible because of the reduction in the amount of burring and nicks.

6. Class A hobs are used to finish cut gears in the transmission when they are straight spur gears of six to seven pitch and over. The shaving operation follows this.

7. The gears are burnished before



Specially arranged tote boxes are used to keep matched gear sets separated while they are being delivered by conveyor to the shipping department

OPERATION PROCEDURES FOR TYPICAL TRACTOR GEARS

SHOP	DRIVE BEVEL GEAR	REVERSE IDLER GEAR
Metallurgical Laboratory	Samples, selected at random from cars of incoming materiial, are tested for chemical composition and grain size before the material is stored in the forge shop. The drive bevel gear is made from flat stock, hot rolled S.A.E. 4120 steel, 6-8 grain size.	Samples, selected at random from cars of incoming materiial, are tested for chemical composition and grain size before the material is stored in the forge shop. This gear is made from round stock, hot rolled S.A.E. 4120 steel, 6-8 grain size.
Forge Shop	1. Shear from flat stock. 2. Drop forge and trim. 3. Normalize. 4. Clean in shotblast.	1. Shear from in. round stock. 2. Head first end (upset). 3. Head second end (upset). 4. Normalize. 5. Clean in shotblast.
Gear Blanking Department	1. Chuck on O.D.; rough and finish face back; rough and finish bore to broach size. 2. Face inner face to grinding width leaving stock on each face for grinding; chamfer bore. 3. Broach bore to grind size in vertieal machine. 4. Drill rivet holes; burr holes on both sides. 5. Rough and finish turn back angle, inner angle and face angle. 6. Locate on inner face and surface grind back face. 7. Inspect.	1. Rough drill bore. 2. Semi-round broach bore, two at a time in horizontal machine. 3. Wash. 4. Straddle face hub leaving stock on each face for precision straddle facing. 5. Chamfer bore on each side in turret lathe. 6. Semi-broach in vertical machine. 7. Turn O.D. of gears, straddle face gears, form $\frac{1}{8}$ in. radius on O.D. of one gear. 8. Precision straddle face in three-spindle automatic. 9. Inspect.
Gear Cutting Department	1. Rough cut teeth. 2. Finish cut teeth. 3. Burr teeth at bench. 4. Wash in machine.	1. Finish hob teeth on $1\frac{3}{32}$ in. wide gear. 2. Chamfer teeth on $1\frac{3}{32}$ in. wide gear. 3. Finish hob teeth on $\frac{7}{8}$ in. wide gear. 4. Burr teeth at bench. 5. Shave teeth of both gears in rotary shaver. 6. Wash in kerosene tank built into portable bench at each machine.
Gear Laboratory	1. Speed test. 2. Transport to heat-treating department, tote pans and industrial tractor.	1. Speed test. 2. Wash in machine. 3. Transport to heat-treating department, overhead conveyor.
Heat-Treating Department	1. Carburize after loading on trays, conveyor-type gas furnace. 2. Quench in centrifugal press. 3. Wash. 4. Draw (same conveyor carries parts through washer and draw furnace). 5. Remove from fixtures, pile in truck. 6. Shotblast. 7. Straighten. 8. Inspect.	1. Carburize after loading on trays, conveyor-type gas furnace. 2. Quench in oil tank with elevators for trays. 3. Wash. 4. Draw. 5. Remove from fixtures, pile in truck. 6. Shotblast. 7. File test bore. 8. Inspect. 9. Burnish teeth of both gears.
Gear Blanking Department	1. Grind bore. 2. Grind locating face. 3. Wash in machine.	1. Broach bore to size in horizontal machine. 2. Wash in machine.
Gear Laboratory	1. Speed test, match with mating gear. 2. Put in special compartments in tote pans ready for packing department.	1. Roll gear. 2. Remove all nicks with hand grinder. 3. Lap gear teeth. 4. Wash. 5. Speed test. 6. Put in special compartments in tote pans ready for packing department.

the lapping operation. Low pressure, (under 200 lb.) is used.

HEAT TREATING—An overhead conveyor brings the gear from the speed test room through the washer and into the heat-treating building. All of the gears for the new tractor are carburized in a Surface Combustion gas furnace. This furnace uses a combination of "char" and propane gas which is mixed with some excess air at low pressures. The gas is let in at the top of the muffle after having been mixed in a chamber just above the furnace.

Two parallel conveyors pass through the muffle. One is used for bevel and other gears which require press quenching, the other for those parts which are to go directly into the oil quench tank. Gears first enter the purging or pre-heat vestibule where they remain for 10 to 15 min. at a temperature of 1,500 to 1,600 F.

An automatic hydraulic system pushes the gears into the muffle. The pre-heat zone temperature is held at 1,700 F., the same temperature which is used in the succeeding three soaking zones. The fifth and final zone is a quenching zone held at 1,625 F. From here the trays and the gears move out on rails which are part of an elevator that drops the gears into a quenching tank below the floor level. The elevator rotates slowly carrying the gears around the tank in a 180 deg. arc. When the next tray of gears is ready to emerge from the furnace the elevator platform and quenched gears have been lifted from the oil tank to the conveyor level. Quenched gears move on to a conveyor which runs through the washer while the next batch of carburized gears in the furnace moves out onto the rails ready for descent into the oil-quench tank.

Those gears which are on the conveyor adjacent to the centrifugal quenching presses are withdrawn through a door in the side of the furnace at the quenching zone end. The operator lifts them out singly with tongs and places them in Gregg-Logan presses where a curtain of oil under a pressure of about 50 lb. per sq.in. is forced on the gears. This curtain starts at the outer circumference of the gear and works toward the center as a vertical tubular column. The amount of travel toward the center of the gear can be controlled so that the gear teeth can be quenched while the bore remains hot. An asbestos pad is placed between each gear as they are stacked upon a conveyor after quenching to slow down the cooling rate of the bore.

Diamonds at Work

By RUPERT LE GRAND
Detroit Editor, American Machinist

NOT UNTIL the advent of the Liberty engine did precision boring with diamond-tipped tools get its real start. Development of precision boring machines later gave automotive and aviation industries, as well as other lines, the opportunity to adopt the process for many fine boring applications where greater uniformity and close tolerances are required on large runs. A single diamond tool may produce 200,000 parts before being chipped and require relapping. Because of their hardness, diamond tools do not wear in the accepted sense; they chip from hitting a hard spot or a hole, or through excessive machine vibration.

Shaped diamond tools are made by master craftsmen, who not only are familiar with diamond cutting practice, but also with the requirements of the machining operation. Diamonds have peculiar properties and require special methods to shape into cutting tools. In this work, the diamond cutter uses a tool layout from 75–100 times actual size and shapes the stone so that its projected shadow shows minute deviations in angularity and radius.

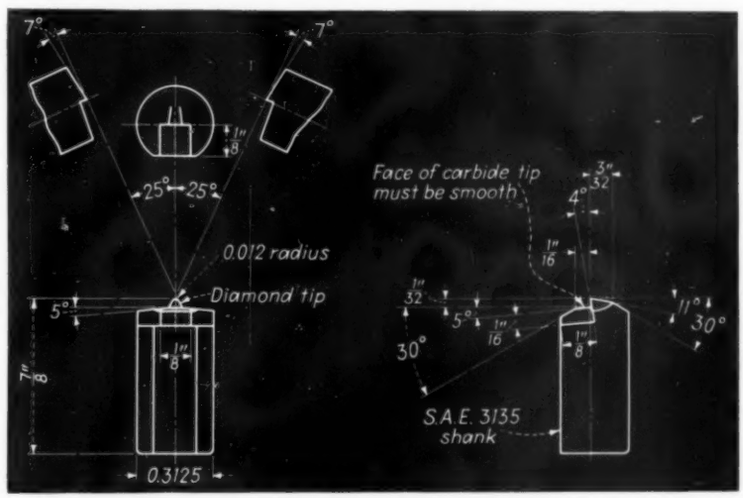
Most shaped diamond tools are made from bortz—a variety that is imperfect in crystalline structure and color, thus not suitable for gem use. Where bortz tools will not stand up "carbonados" are substituted, although the original cost is higher and they are more difficult to shape.

Stones of from 0.15–1.25 carats are required for most diamond tools. Small tools for boring ½-in. bushings take a $\frac{3}{16}$–$\frac{1}{4}$-in. holder and a stone from 0.30–0.35 carat, but the usual run of boring tools need a stone as large as 0.5–1.0 carat. Larger tools and form tools may take considerably larger diamonds. Diamonds have not been used in multiple on a form tool because the joints cannot be made exactly smooth.

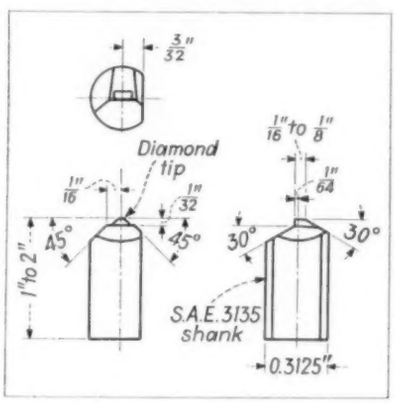
After the stone is shaped, it is fixed in position on a round or square toolbit, either by brazing or by means of a cold setting process. The advantage of the round holder is that the stone can be rotated to achieve the desired top side rake. A flat is milled on the shank so that the holder can be clamped at that angle by a setscrew in the boring bar or tool holder.

On aluminum, the positive back rake usually is 4–5 deg. to get a good shearing cut, but some tools used on brass are made with several degrees of negative rake. No rake is used for copper, and the tool is set on the centerline to prevent catching and digging in. The radius on the cutting edge varies, usually as follows: for aluminum, 0.008–0.010 in.; for brass and bronze, 0.012–0.125 in.

Diamond tools require fine feeds, because of their brittleness; high speeds, up to 3,000 r.p.m.; tight spindle bearings, fitted to 0.0002 in. clearance and replaced when worn to 0.0004 in. clearance; and machines specially designed for their use, not makeshift spindles. They should not be expected to correct inequalities left by previous machining operations. Taking most of the stock off one side throws pulsating loads on the diamond which is detrimental to its life. Stock removal of 0.003-0.004 in. per side is good practice and is conducive to maximum tool life. Many shops remove as much as 0.005–0.008 in., but their tool repair cost is higher.



A late development in diamond-tool design is the cemented-carbide insert above the diamond to assist chip disposal when machining stringy, gummy materials. This tool is for boring the wristpin hole in an aluminum-alloy

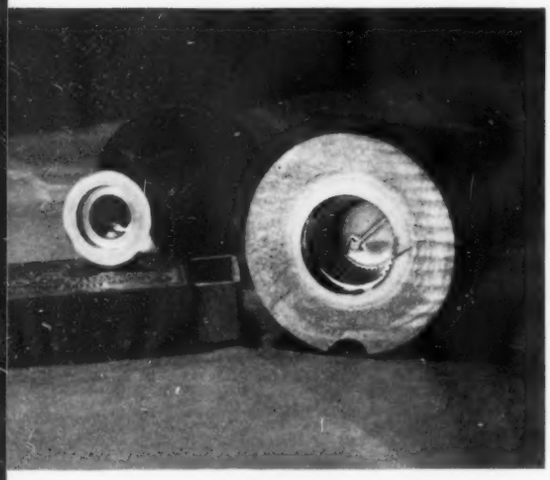


A common type of boring tool has an included angle of 90 deg. on the shaped diamond. Clearance on the front face is 8–10 deg. and the radius on the cutting edge varies from 0.010–0.020 in., depending on the diameter of the bore

Acknowledgements are made to the following companies for data supplied: Arthur A. Crafes & Company, Koebel Diamond Tool Company, Anton Smit & Company, and J. K. Smit & Sons.

Chrome-surfacing prevents matte surfaces from rapidly wearing smooth when molding slightly abrasive material. Plating often increases by five or six times the production from unplated molds

No matter how continuous the production, molds do go into storage—and usually come out needing repairs. Chrome-surfaced molds do not tarnish or corrode, scratch and mar far less easily than steel—seldom need first aid after storage unless carelessly handled



Photographs courtesy of Garfield Mfg. Co.

Plating protects plastic molds

By EDWIN SMITH
Keystone Chromium Company

DURING the past few years chromium plating has become the almost universal method for surfacing molds and dies employed in plastic molding. For work with compounds, which attack ordinary steel, and with the newly developed translucent and transparent compounds, chrome-surfaced molds are less expensive than molds made of any other stain- and rust-resisting material.

The accompanying illustrations of chromium plated molds employed on a variety of plastics, including hard-rubber, illustrate the value of chrome-surfacing. Plating on these parts was done by the Industrial Chromium & Engineering Company.

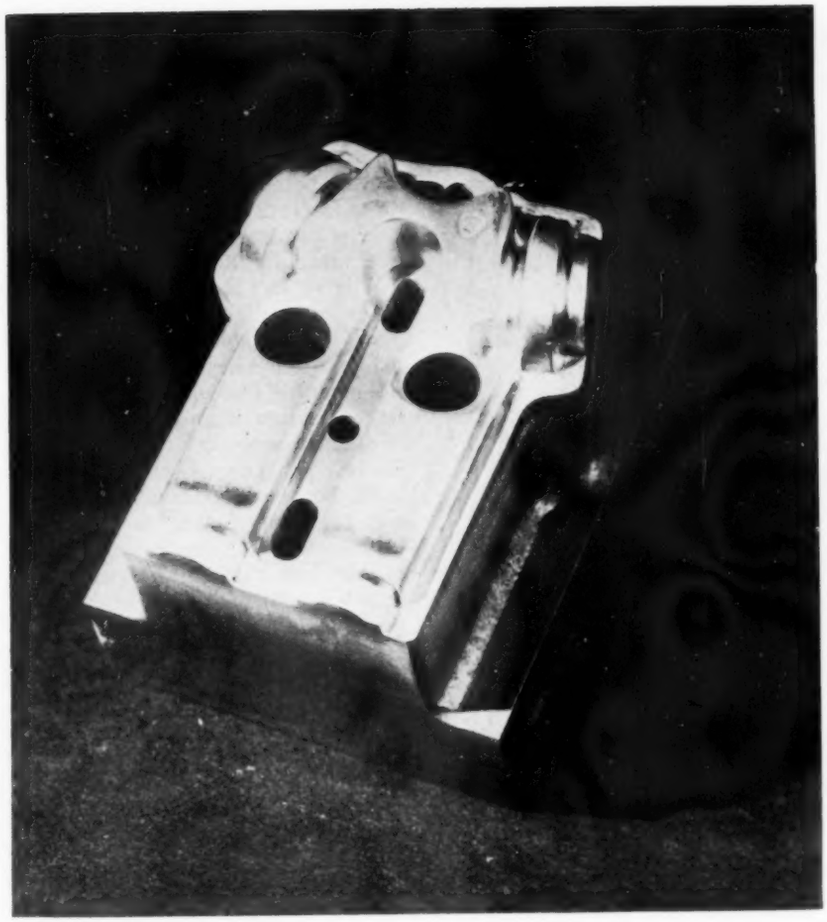
Chrome-surfacing a plastic die is more nearly allied to tool-making than to metal finishing. Consequently the work is beyond the capacity of the ordinary shop engaged primarily in plating for decorative purposes.

The best thickness of chromium is the least that will do the work properly. All that is needed for many classes of work is 0.0003 in., provided that the chromium is 0.0003 in. thick everywhere, down in the corners as well as on the projections. The thickness more generally employed on molds used with the synthetic resins is 0.0004 to 0.0005 in. while molds for hard-rubber frequently have chromium plated to a thickness of 0.002 in.

Chromium must be deposited evenly; for best results it must have a close-grained brilliant character. The diemaker should always polish the chromium surface after plating, and the plater never, before placing the mold in production. As soon as the slightest wear is apparent, exposing the steel, the mold should be stripped of all remaining chromium, carefully polished and replated. Molds handled this way may be replated indefinitely.

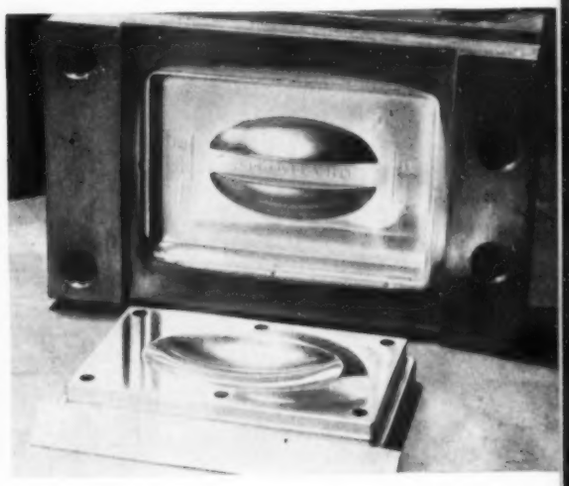
SEVEN ADVANTAGES OF CHROME-SURFACING

1. Elimination of corrosion by molding compounds.
2. Elimination of sticking of molded articles to molds.
3. More highly polished finish may be obtained on molded articles.
4. Original surface of design is reproduced more faithfully.
5. Elimination of corrosion of molds in storage.
6. Increased mold life.
7. Decreased mold maintenance.

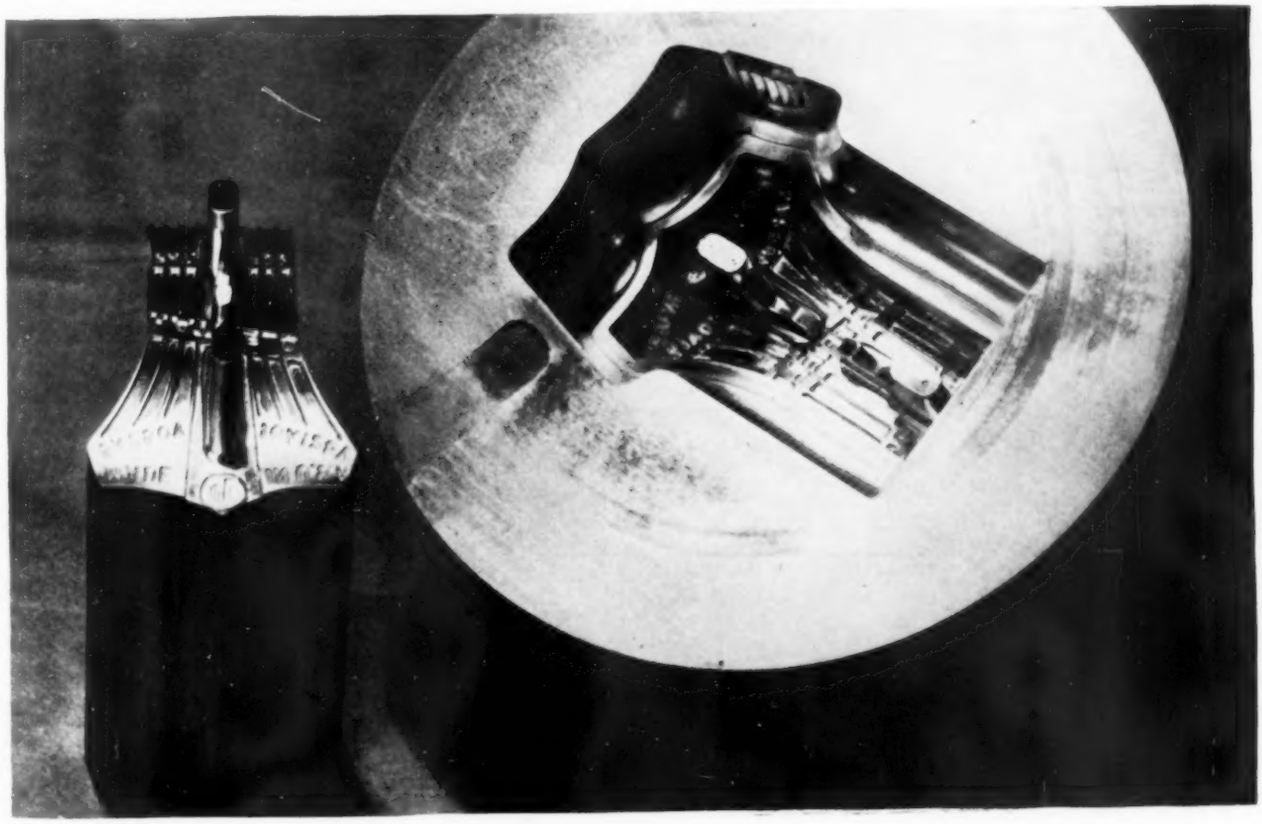


A worn steel mold is fit only for junk. The mold part was chrome-surfaced to 0.0005 in. when new. As soon as the slightest sign of steel showed through, the mold was stripped clean, polished and replated for ten dollars. This mold has been replated three times and is still in use

The finish of the part is never better than that of the mold. Chromium takes a higher polish than steel and is less easily scratched



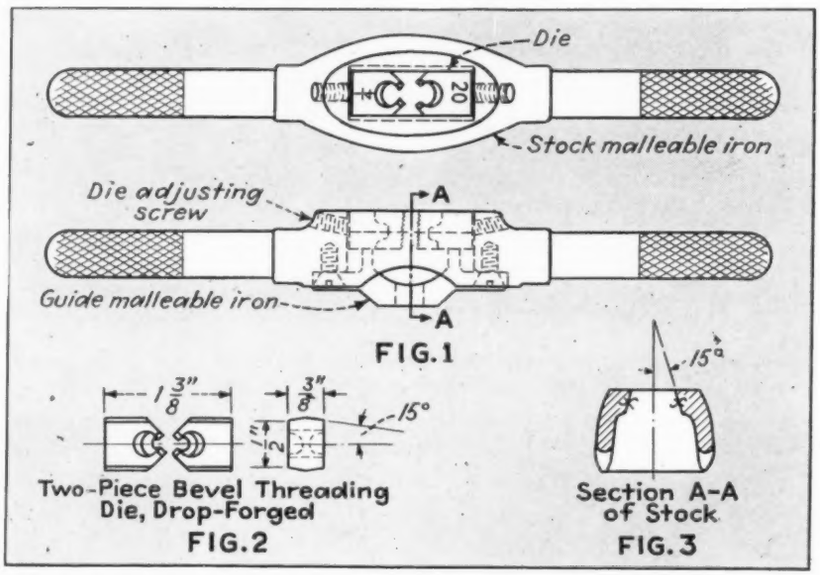
When the piece sticks to the mold, production is slowed and the part may be ruined. Molded parts do not stick to a chromium surface, whether polished or rough



Press Forming A Casting

Holding edges of die stocks are beveled with press tools. It's an unusual operation

By HERBERT M. DARLING



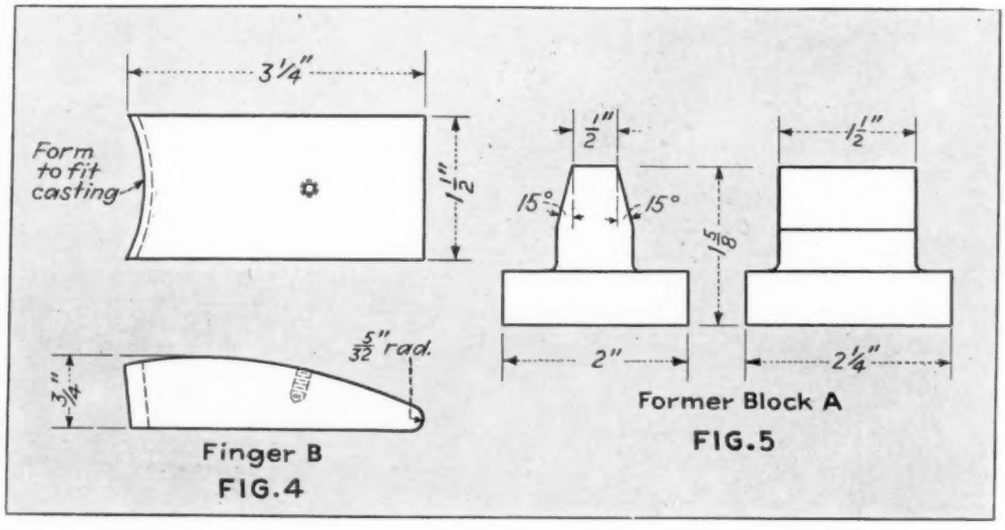
Figs. 1, 2 and 3—Die stock assembly made in Japan has drop-forged dies and a malleable iron stock. The 15-deg. beveled holding edges of the stock, Fig. 3, are press formed

INSTEAD of machining the beveled edges of stocks for holding full-mounted die sets, Sonoike Seisakusho, Tokyo, Japan, presses this part to finished dimensions directly from the casting. Also, the two-piece bevel dies are made from drop forgings, rather than from cold-drawn steel as in American practice. Dies made by different manufacturers are interchangeable in various stocks, three sizes of which cover the range usually furnished in screw plates.

Fig. 1 shows a die stock used in a full-mounted screw-plate set. Such a set contains a complete assortment of dies, covering a certain range, each die being mounted in an individual stock. For the purpose of this article only one die is shown, that is a $\frac{3}{8}$x$\frac{1}{2}$-in. size with a 15-deg. beveled edge, as shown in Fig. 2. These dies are seated accurately in a recess in the stock which is seen in Fig. 3.

In the past these 15-deg. faces were machined on a shaper by mounting the work in an angular indexing fixture. This operation proved to be slow and at times inaccurate. One manufacturer broached these surfaces with success. All of these dies have been furnished in round collets, or in full-mounted stocks having a large round central portion. A full-mounted set is ideal for mechanics' use, having each die mounted in its own stock ready for instant use. However, the cost and the added weight of the ordinary full-mounted set have prevented its common use.

To overcome these objections, the stock shown was designed for both light weight and ease of manufacture. The die is held in the stock by the guide casting which presses on each half of the die, forcing them tightly into the bevel seat by pressure of the two screws shown. The hole in the



Figs. 4 and 5—The form block A *is slidably mounted in the die shoe as shown in Fig. 6, and centralizes itself between the pressure fingers* B

guide is $\frac{1}{64}$ in. larger than the size of the steel rod to be threaded so the die will start on the work straight.

In place of machining the bevel die seat with shaper tool or broach, this stock was designed and correctly proportioned for finishing the seat in a press, using the tools illustrated in the accompanying drawings.

The Casting Is Formed

The details of the forming block, holding fingers and assembled tools for forming this bevel seat are shown in Figs. 4, 5 and 6. The stock casting is mounted on the former block *A* and pushed into place between the two pressure fingers *B*. In this position the punch *C* descends, forcing the two pressure fingers *B* against the sides of the casting. At the same time the casting is forced down onto the former block *A*, until the punch just meets the upper face of the block *A*. In this position the die seat is accurately finished to size and angle by *A* while being held on the sides by the fingers *B*, which prevent the casting from opening sideways.

The former block is shown in detail in Fig. 5. It is not fastened to the die, but is free to slide sideways and centralize itself between the pressure fingers, which are held in the idle position by the flat springs. These pressure fingers, shown in detail in Fig. 4, are formed to fit the contour of the sides of the casting. The small ends of the fingers are formed to fit the radii in the corners of the die block *D*; thus, they are free to move and are supported adequately by the heavy die-stock.

This set of press tools is inexpensive and simple, but at the same time quite efficient, helping to complete the manufacture of a satisfactory full-mounted stock in an economical way.

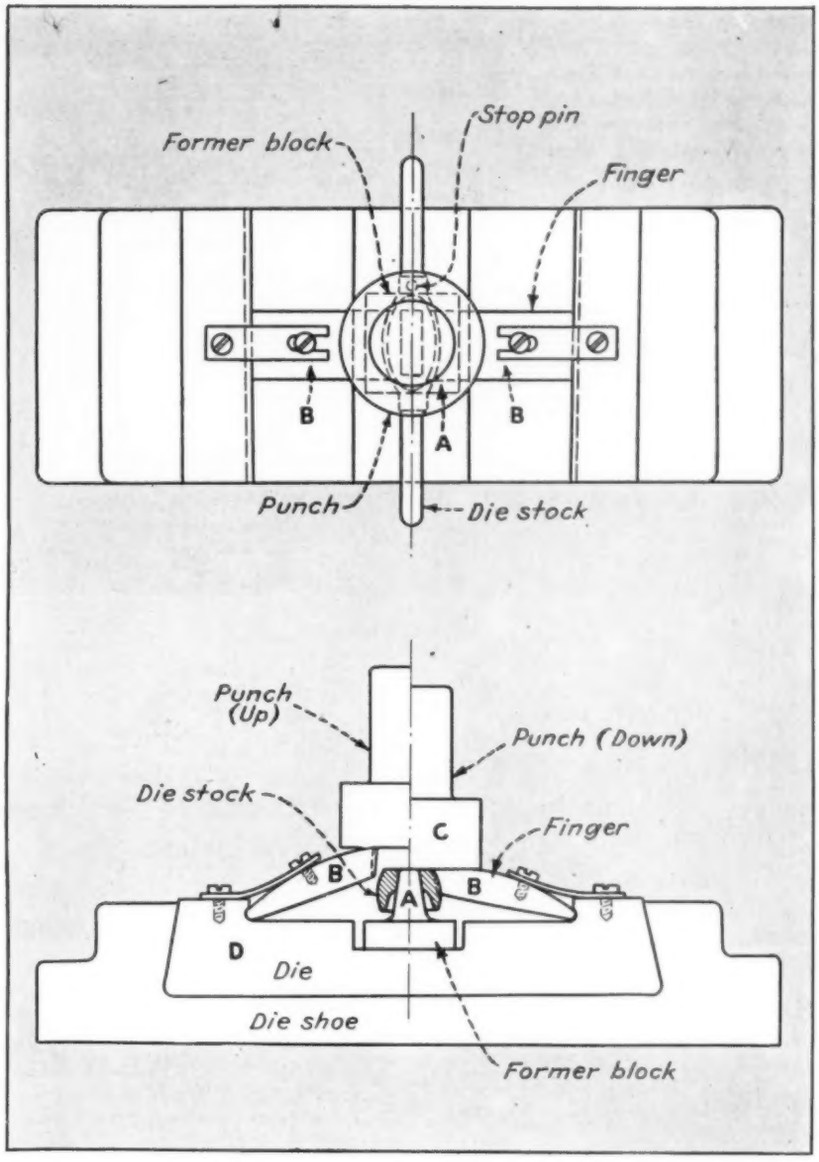


Fig. 6—This press tool forms the beveled seats on the die stock. It is finished to correct size and angle over the form block A *as the punch* C *descends. Fingers* B *prevent the casting from moving sideways*

Processing of Plastics

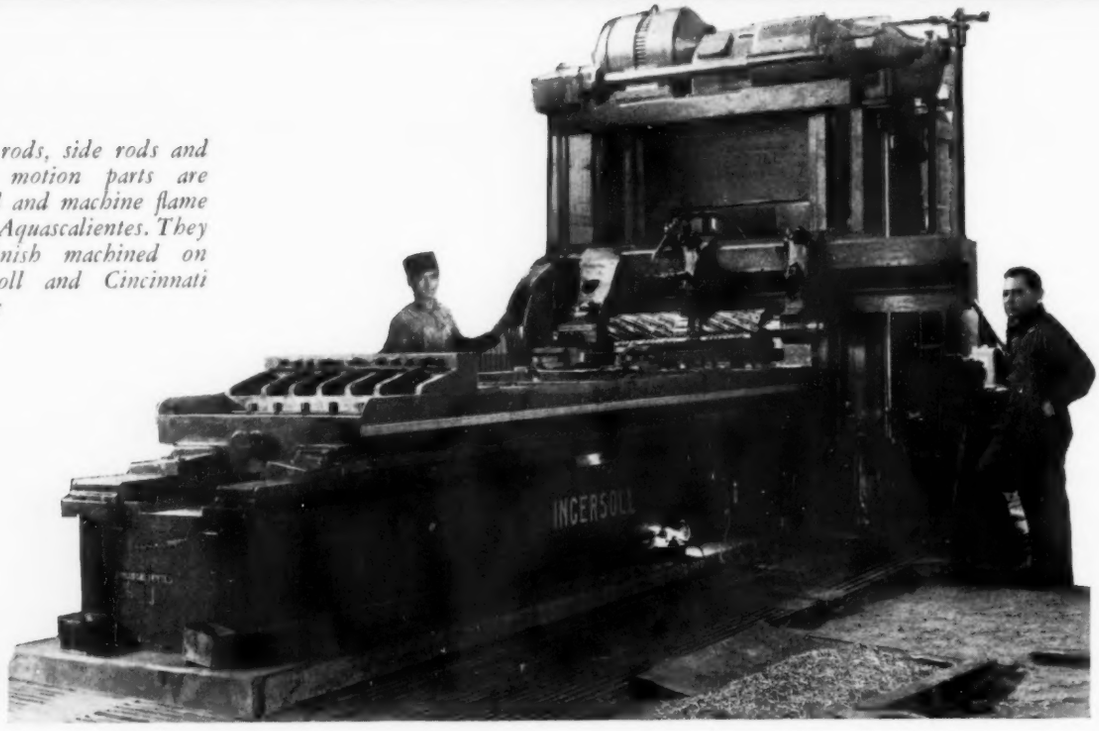
By C. H. PENNING
Tennessee Eastman Corporation

We have been interested in reading the special section entitled "The Processing of Plastics" (*AM*—Vol. 83, page 483) and, all told, it is an excellent job. There are, however, one or two small points in the tabulations which appear questionable.

For instance, in the table at the bottom of page 484 you show the specific gravity of cellulose acetate plastics as ranging from 1.26 to 1.60. We do not know of any cellulose acetate molding composition running as high as 1.60 in specific gravity. In order that it do so it would have to be loaded very heavily with pigments, thus reducing its impact strength without improving any other property. The upper limit should be somewhere around 1.37 for these plastics.

The upper limit on moisture absorption of cellulose acetate material, as shown in this table, also is a bit high. We have not found it to be over 3 per cent in 24 hr. for any of the ordinary types of cellulose acetate plastic.

On page 486 you list as a second type of material "cellulose acetate and acetobutyrate." The characteristics, trade names and principal applications, however, apply entirely to cellulose acetate. The mixed ester product, properly termed cellulose acetate butyrate plastic, is not compatible with cellulose acetate and is very little affected by water. It should have been classified separately.

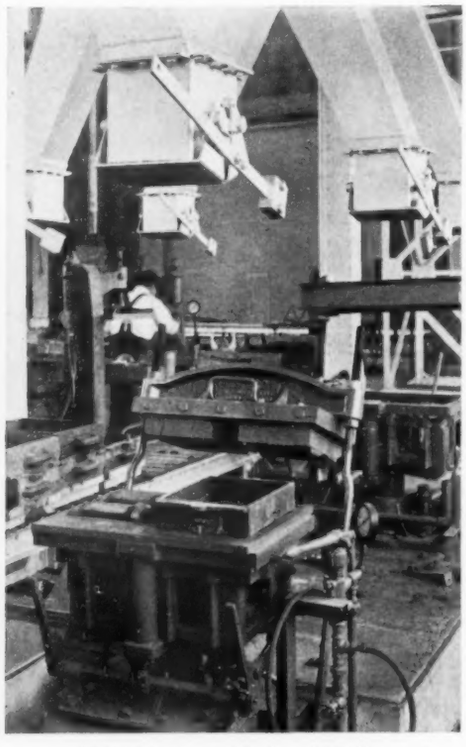


Main rods, side rods and valve motion parts are forged and machine flame cut at Aquascalientes. They are finish machined on Ingersoll and Cincinnati millers

South of the Border

Mexican National Railway has stressed the value of new machine tools. This policy is to continue as shops are rebuilt

By FRED H. COLVIN
Editor Emeritus, American Machinist



The Mexican National Railway produces many of its own castings in this modern foundry. It is complete with sand mixers, conveyors, overhead storage bins and tamping equipment

WHILE MANY of the back shops and enginehouses of the Mexican National Railway are old and lacking in modern repair facilities, hundreds of new machine tools have been installed in recent years. Nearly all are of American make and include such names as Acme, American, Bullard, Cincinnati, Colburn, Gisholt, Greenlee, Jones & Lamson, Niles, Oster-Williams, Sellers, Warner & Swasey, and others.

Repair Practices

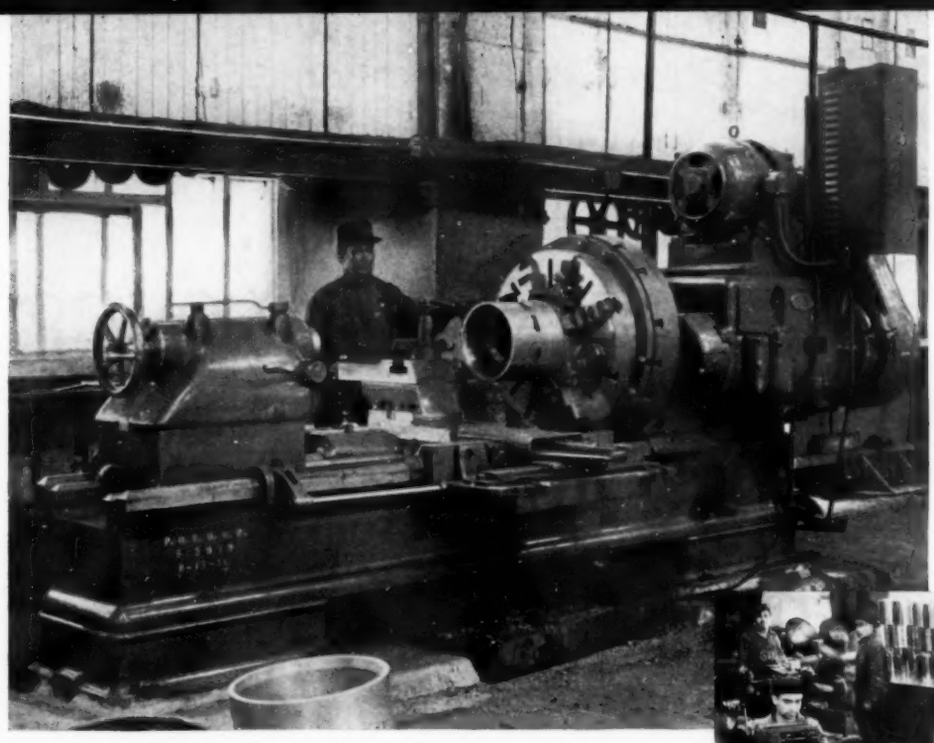
Locomotive and car repair practice quite naturally follow that of American shops. In fact, it is a part of an existing training plan to send men from different shops to representative shops of the Southern Pacific Railway to familiarize them with the methods in use north of the border. Such practices as best meet their needs will be applied in Mexican shops. Executives and men alike seem anxious to improve equipment, methods and efficiency in every possible way.

The main shops of the Mexican National Railway are at Aquascalientes, 586 miles north of Mexico City. Here the buildings and machine tool equipment are the equal of any in the United States.

The shops at Monterrey were built many years ago and are inadequate to meet their present needs, especially as to facilities for housing locomotives. However, it is planned to build an enginehouse at this terminal to accommodate 100 locomotives.

Another of the old shops is at Nonoalco, a suburb of Mexico City. As at Monterrey, the buildings are old and the layout is not all that is to be desired. But here too plans are under way for better accommodations for both men and machinery.

Practically all forging and heavy machine work is done at Aquascalientes. Main rods, side rods, and valve motion are forged and machine flame-cut; they are finished on Ingersoll and Cincinnati millers. Inserted-blade helical milling cutters are kept in condition on a modern cutter grinder of sufficient capacity to handle even the largest sizes. An Ingersoll cutter grinder, with the wheel head adjust-



Valve bushings, main ana side-rod bushings, wrist pins and crank pins are machined in this American lathe at Aquascalientes. Similar units are in service at outlying shops and enginehouses to handle both running and backshop repairs

The main shop at Aquascalientes functions as a manufacturing center for many locomotive parts. All sheet-metal products, including boiler jackets, light reflectors, and oil and water cans are made there and shipped to outlying shops and enginehouses

able in both directions, is also used.

The main shop at Aquascalientes functions as a central repair shop and manufacturing center for many small locomotive parts which can be conveniently shipped to outlying shops and enginehouses. Valve bushings, rod bushings, crank pins, wrist pins, piston and valve stem packing, and miscellaneous bolts are turned to approximate finished size on the most modern of lathes. Landis and Oster-Williams machines thread all types of bolts for distribution over the railway. Staybolts are threaded on six-spindle Colburn units. Bolts, nuts, brass valve parts, gage, air brake parts, are produced in new high-speed turret lathes. A variety of Niagara bending rolls, brakes, shears, crimpers and rotary cutters are used for making sheet-metal products, including locomotive jackets, jacket bands, and all types of oil and water cans.

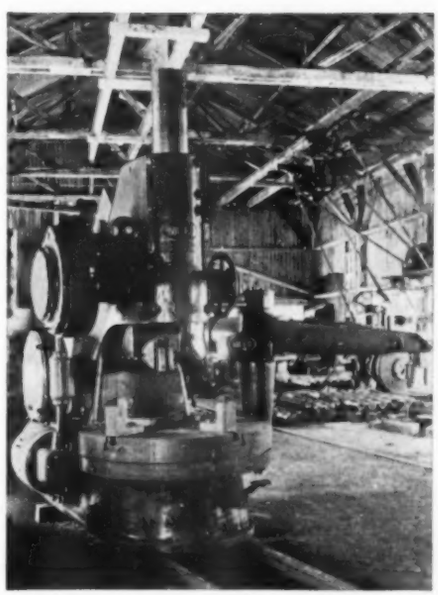
Equipment at Outlying Shops

Cylinder saddle frame fits are machined on Morton draw-cut shapers. Valve chambers and cylinders are bored on the latest type boring mills.

In the boiler shop at Aquascalientes is rolling, forming, forging and material-handling equipment for fabricating boiler courses, firebox sheets, throat sheets and tube sheets. As in American shops, welding is playing a more and more important part in locomotive repairs. The welding shops at the various back shops of the Mexican Railway are as completely equipped with American-made welding units as any shop north of the Rio Grande.

Although the shops at Monterrey and Nonoalco are antiquated, the machine tool equipment is good but not comparable to that at Asquascalientes. Most of the new machines are shapers, drill presses, and lathes, although an adequate number of center-drive journal turning lathes, wheel lathes, and quartering machines have been installed to handle effectively repairs to locomotive driving wheels, as well as engine, trailer and tender truck wheels.

Having built a modern shop at Aquascalientes and equipping it with modern machine tools, the officials of the Mexican National Railway have up to this time stressed the installation of modern equipment in all shops. They are now turning their attention to building modern enginehouses and back shops at other division points. When such plans are completed, the installation of modern machine tools will receive further impetus.



Hundreds of American made machine tools have been installed in recent years on Mexican railways. This Niles car-wheel boring mill, just received at Aquascalientes, is one of several purchased during 1939. Other units are at Monterrey and Nonoalco

When Precision Was Young

Captain Hall's early work in rifle manufacture formed the basis of modern interchangeable production. But today this pioneer is all but forgotten

By LT. COL. E. E. MacMORLAND
Ordnance Department, United States Army

IN MAY, 1811, the President granted letters-patent to Captain John H. Hall for certain machines designed to make firearms with interchangeable parts. The inventor claimed that the machines devised by him would produce each part in such an accurate and uniform manner that it would fit exactly in any arm of similar model.

Some authors claim that Captain Hall was not the originator of interchangeable manufacture. Simeon North is said to have introduced a system of interchangeable production prior to the work of Hall, and Eli Whitney, inventor of the cotton gin, also devised ways to effect a division of labor by which each part was made separately and with accuracy. Hall's great contribution to interchangeable manufacture was that of accurate machines, the precision tools of his day.

Hall brought his method to the attention of the Government in 1813, and General Armstrong, who was then Secretary of War, ordered for trial a few rifles produced with his machines. By January, 1817, the Secretary of War had convinced himself that Hall had indeed justified his claim and a contract for 100 rifles to equip a company of riflemen was given to Hall. This small lot went through a series of tests by a board of military officers with such success that Hall received another contract in March, 1819, to supervise the production of 1,000 rifles at Harper's Ferry Armory. He agreed to accept $1.00 per rifle and became an assistant armorer on the government payroll at $60 a month.

After fabrication of his machines and instruction of the workmen, Hall began manufacture of the first order of 1,000 rifles. He encountered and overcame many difficulties, and it required six years to produce this order. In 1824, when he was near completion on the initial order, his contract was increased to 2,000 rifles. In the first order, the average cost per rifle and bayonet was $17.82, while on the second order he was able to reduce the price to $11.97. This great price reduction was caused not only by increased skill of the personnel but by improvements to the machinery which Hall made during the course of the original contract. Like all true mechanical geniuses, Hall refined his machines as he went along and finished his second lot of 1,000 rifles in two years rather than the six years required for his first order. Exhaustive tests on these rifles proved that they were far superior to any types then in existence in safety, accuracy, rate of fire, and durability. All were also perfectly interchangeable as to parts.

"Water power ought to be applied to this machine, as it would save much manual labor, and that of a severe kind"

During the course of his second contract, the unusual results achieved by Hall attracted the attention of the administration in Washington, and a commission of mechanical experts was sent to Harper's Ferry by the Secretary of War in 1827 to examine Hall's methods. The remarks to follow are based on the original report of the commissioners, whose enthusiastic account bears witness that they realized that a great improvement in manufacturing methods had been invented.

The remarkable achievement of perfect interchangeability rested on the accuracy and design of the machines invented by Hall. The inventor himself classified them as great and small forging machines, straight and curved cutting machines, lever and woodworking machines, adhering to his terminology.

The drop or "great" forging machine was devised so that the piece being forged could be quickly

forced out of the forming "swedge" and quenched to preserve the temper, no matter how deep it was driven into the "swedge" or how complicated in form. The small forging machines were constructed on the same principle, and like the great forging machine, combined great stability and strength.

The cutting machines were of three types—straight cutting, curved cutting, and lever cutting. As their names imply, the straight and curved cutting machines were used to produce straight, or flat, surfaces and curved surfaces; the lever cutting machine came into use for operations which could not be performed by the other cutting machines.

The drilling and milling machine used for various operations seems to have been a very accurate device, with provision made for precise adjustment, and, in the words of the commissioners, "distinguished, also, by its conical and perfectly similar and concentric sockets, into which are introduced a variety of implements, on whose horizontal surface lies the work to be drilled or milled, always at right angles with the milling or cutting instrument."

Wherever possible, Hall's machinery was belt driven. He seems also to have developed effective bearings for his shafting, since the pulleys of all his machines revolved without the "shaking and trembling which frequently accompany their motions." I have been unable to determine just what source of power was used, but assume that the strong backs of men must have been the source. In referring to the great forging machine, the commissioners commented that "water power ought to be applied to this machine, as it would save much manual labor, and that of a severe kind, and its utility thereby be much increased." They also refer elsewhere to other machines to which water power should be applied.

These machines were so nearly fool-proof that their operation could be entrusted to small boys. Hall actually used boys 12–15 years of age, supervised by older workmen, to operate his machines. Five or six boys worked under the direction of each skilled workman. The daily wage of the boys was 35 cents; the supervisors received $1.75. There were no child labor laws in those days, and it was frankly conceded that one of the greatest advantages of the machines in reducing costs was their easy use by cheap labor.

The proof of the interchangeability of parts was established by the commission during their visit to Harper's Ferry. One hundred rifles, made by Hall's method, were withdrawn from the Arsenal, and completely disassembled. The parts were mixed indiscriminately and then assembled to one hundred stocks from the current woodworking production. It was found that all rifles re-assembled with perfect fit throughout. "And we very much doubt," quaintly concluded the commissioners, "whether the best workmen that may be selected from any armory, with the use of the best machines in use elsewhere, could, in a whole life, make a hundred rifles, or muskets, that would, after being promiscuously mixed together, fit each other with that exact nicety that is to be found in those made by Hall."

"And we very much doubt whether the best workman . . . could in a whole life make a hundred rifles, or muskets, that would, after being promiscuously mixed together, fit each other"

Test Proved Superiority

Two companies of troops at Fortress Monroe were armed with Hall rifles in July, 1826, and extensive service tests thereafter indicated that they were greatly superior in performance to any other arm previously used. To interchangeability of parts had been also added superior performance. About a year later, four other companies at the Infantry School of Practice, then at Jefferson Barracks, Mo., received Hall rifles.

Production of Hall rifles continued each year in small quantities, but this improved arm did not, as might be expected, displace the time-honored musket. By 1840, about 15,000 of these rifles had been made. During the period from 1819 to 1835, Hall was a Government employee. It seems that he received $29,583.90 in royalties and salary during these sixteen years, a rather modest return for his outstanding contribution to the production of small arms and, it may be added, to the development of industry as it exists today. The Government paid for the machinery and Hall's many improvements during this entire period. The cost was about $150,000, all of it expended at Harper's Ferry Armory.

It may seem strange that the Government did not scrap its musket facilities and go into the exclusive production of these better rifles. Apparently attempts were made by the Chief of Ordnance to accomplish the change, but he was not successful. The Mexican War was fought with muskets which had changed little in design since the War of 1812.

Although Hall's machinery was not used at Springfield Armory during this period, somewhat similar machines were later developed by this Armory for musket production, making less necessary the skilled and highly specialized file-and-small-tool artisans who had heretofore been considered indispensable and who periodically embarrased the administration by wage demands. Several private armories, notably that of Colonel North, used Hall's machinery. North was finally able to produce the Hall rifle for $17.20 at a time when Harper's Ferry production cost $14.50. Hall was still ahead of all competitors in the matter of costs. He seems to have been a good manager as well as a mechanical genius.

So far as can be determined, Hall is the father of the precision manufacturing equipment so essential to low cost modern production. He was evidently ahead of his time and had it not been for the Government support he obtained for the creation of his machines and the production of a sizable quantity of rifles to test them, it is doubtful whether he would have ever received any recognition in his time. Today he is forgotten, unless these few paragraphs will serve to revive appreciation of his pioneer work that has had such a far flung influence on American industry.

Lapping for Final Finish

III—Lapping is used successfully for gears as well as cylindrical and flat surfaces. Here is how it is done

By H. J. WILLS
Engineer, The Carborundum Company

BY LAPPING it is economically possible to remove cutter and chatter marks from gears, correct small imperfections in profile and spacing, correct distortion caused by heat-treating, and reduce friction to a minimum when the gears are in operation. Gears that have been discarded on account of surface defects often can be reclaimed by lapping.

Gears may be mounted in a lapping machine or lathe and lapped on centers. Some shops lap on running centers only, others lap on wide centers and still others favor lapping on close centers. It is our experience that the best results, with both soft and hardened gears, are achieved by lapping in all three ways, with a light load applied to the driven gear. The speed should not be so high as to cause the compound to fly off.

After the gear starts rotating, the lapping compound is applied with a brush. Enough compound should be used to moisten the entire surface of the gear teeth. The first gears should be examined frequently during lapping, to determine how long is necessary to give the desired finish, and this time used as a standard. Time can be wasted by continuing the process longer than necessary. After lapping, the gears should be thoroughly cleaned by spraying or brushing with a cleaning solution.

If the production of gears is small or intermittent, or if lapping equipment is not available, gears of all kinds can be satisfactorily lapped by assembling them and running them in their cases with proper compound. The compound should be used sparingly so that it will not flow or drip from the lapped part and so run the risk of getting into the bearings.

Following are the general types of lapping compounds suitable for lapping *hardened steel gears:*

Crankshafts can be lapped inexpensively with a leather-lined "nut cracker"

For fast cut on rough gears: silicon carbide 90 grit, grease vehicle.

For general use: silicon carbide 150 grit, grease.

Commercial finish, small gears: silicon carbide 220 grit, grease.

Smooth finish, large gears: garnet 220 grit, grease.

Smooth finish, small gears: garnet FF, grease.

Soft steel gears require a compound which will cut rapidly, give a smooth surface and not impregnate the metal.

In lapping mild and cast steel, cast iron and semi-hardened gears, it is essential that the gears be not allowed to run dry. It is therefore necessary to add machine oil from time to time to replace what has been taken up by the metal. For fast cutting on these materials, the following types of compound are recommended:

Gears of coarse pitch or where considerable stock is to be removed: aluminum oxide, 90 grit, grease.

Average gears: aluminum oxide, 150 grit, grease.

All fine pitch gears: aluminum oxide, F grit, grease.

Very fine or small gears: aluminum oxide, 1,000 grit, grease.

Where less stock is to be removed, or a smoother finish is required, somewhat slower cutting compounds may be used:

Coarse pitch gears: garnet, 150 grit, grease.

Average gears: garnet, 220 grit, grease.

Fine pitch gears: garnet, FF grit, grease.

When a long lapping operation is preferred, a more liquid compound than the grease ones listed above may be used, applying with a brush or pouring onto the gears. The vehicle

is a soluble oil. As the gears begin to dry, plain water is added.

Worms and worm gears are lapped with a fast cut which will give a high finish free from grain marks. When worms only are lapped they are mounted between centers on a driving spindle. The lap is made of cast iron, fiber or Micarta with the same tooth form as the worm gear which will be used. It is mounted on a two-way carriage and centered with the worm threads. After the machine is started the compound is applied by brush. The lap traverses the worm in each direction for the full length of the threads. The lap may be replaced by the companion worm gear and the two lapped together in operating position. The following compounds are recommended:

Worms only, large—silicon carbide, 220 grit, grease.

Worms only, small—For fast cut: silicon carbide, 220 grit, grease. For medium cut: aluminum oxide, F grit, soluble oil. For fine cut: aluminum oxide, FFF grit, soluble oil.

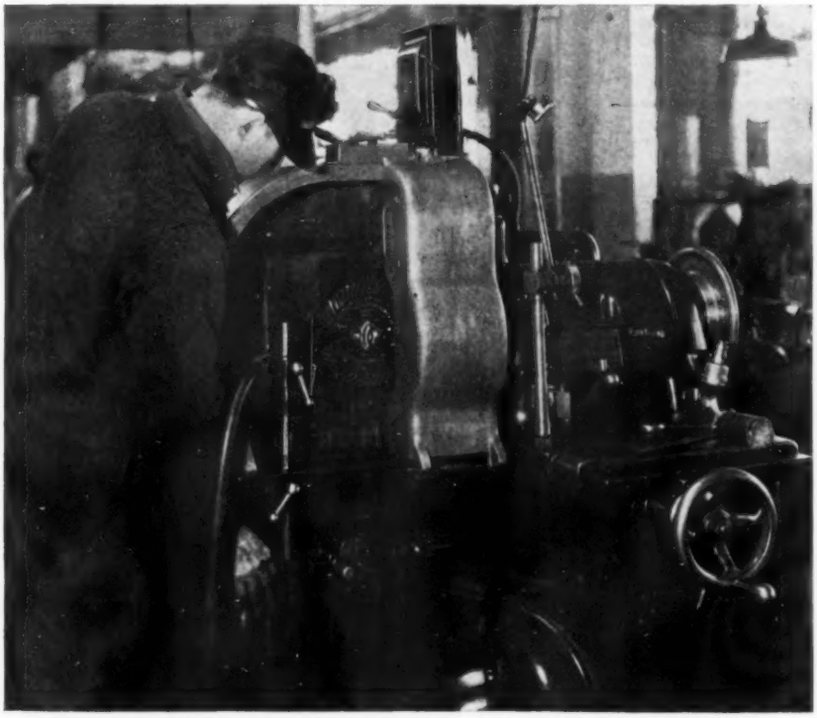
Worms and gears, or gears only—For fast cut: garnet, 220 grit, grease. For medium cut: garnet, FF grit, grease. For fine cut: aluminum oxide, F grit, soluble oil.

For lapping transmission gears on National Broach machines a silicon carbide grease compound is used in 150 or 220 grit—usually the coarser.

For lapping spiral bevel and hypoid gears on full and semi-automatic machines, it is essential that the vehicle in which the abrasive is suspended be thin enough to flow readily and yet of sufficient body to hold the abrasive in unchangeable suspension, uniformly separated in all directions. The compounds should be thinned with kerosene oil or, if the cutting action is too harsh, with a light oil. The supply shold be refreshed daily with unthinned compound.

Recommend for gears of this type are:

For heavy truck and bus gears: silicon carbide, 120 grit, oil.



Where quantities warrant, best results are obtained from machines especially designed for lapping; this bevel gear lapper is a good example

For rapid cut on average gears: silicon carbide, 150 grit, oil.

For normal cut, average gears: silicon carbide, F grit, oil.

For very particular work, or where but little lapping is needed—especially for hypoid gears: silicon carbide, FF grit, oil.

These compounds have a free cutting action. To replace an old supply of compound with a completely fresh batch of any of these compounds will simetimes upset the standard lapping procedure. It is therefore best to retain the old compound in the machine reservoir and add the fresh compound, little by little, as the old supply becomes depleted.

Ball bearing raceways are lapped to remove grinder fuzz, chatter marks and surface waves. If the raceways have been imperfectly ground and show chatter marks, the lap should be made of lead. At the start, heavy pressure is applied. The pressure gradually is reduced as the lapping progresses. An aluminum oxide abrasive, 90 grit, grease compound is used.

If the surface of the raceway is fairly good a whitewood or leather lap is used with an aluminum oxide, 150 grit, grease compound, using a constant heavy pressure throughout the operation.

If the ground surface is smooth, and an exceptionally accurate surface of good appearance is desired, a hard white Mexican felt lap, Grade E, should be used with an aluminum oxide, 150 grit, grease compound, maintaining an even pressure.

Laps for raceways may be held with either expanding or contracting pliers. When lapping outer raceways the lap may be attached to a stick. For inner raceways the lap is in strip form and applied by hand.

For all lapping the raceways should be revolved at about 2,000 surface ft. per min. The lap should have at least a 35 deg. arc of contact with the raceway.

Crank pins and crankshaft bearings are lapped to remove grinder fuzz, and to insure accuracy as to concentricity, parallelism and radii. This may be done with lapping machines or by hand.

If finish only is required, the "nut cracker" lap is used in connection with either abrasive paper, or preferably, with a leather lining. Heavy pressure is applied and the tool oscillated while the crank revolves. Use the following compounds:

For rough ground surfaces: aluminum oxide, 90 grit, grease.

Smooth ground surfaces: aluminum oxide, 150 grit, grease.

Fine ground surfaces: aluminum oxide, F grit, grease.

After using one of the above, a high polish may be secured by using aluminum oxide, F grit, soluble oil.

When high accuracy is needed on such parts as high grade automotive or airplane engine cranks, the above operations may be preceded by lapping with a split cast iron lap, using a compound of aluminum oxide, 220 grit, oil vehicle.

Large cylindrical parts such as large journals, and rolls for precious metals, foils and glazed paper, can be given high accuracy and finish by lapping.

Parts of from 4 to 8 in. in diameter are lapped with a split cylindrical

lead lap, which is made by casting the lead around the part in a tapered cast iron mold. The lap is slit lengthwise and removed in one piece. The mold is used to compress the lap by driving it up on the taper. Compound is applied to the part, which is rotated at about 300 r.p.m. The lap is held stationary except for a traversing or oscillating motion. The compound is aluminum oxide with an oil vehicle, of 220, 320 or 800 grit, as required.

For parts of greater than eight inches diameter, a lead lap is turned or molded with an inside diameter about 0.003 in. larger than the outside diameter of the work. It should be about 6 in. long, with flat sides and back, and split into halves allowing a $\frac{1}{2}$-in. gap. The lap is held on the work with a moderate pressure by means of an adjustable steel clamp. The part is rotated on a lathe, the lap being held rigidly on the table and traversed with the table. The compound, of the same type as used for the smaller diameter parts, is applied with a brush ahead of the lap. If lap scrapes off abrasive, edges of the working surfaces may be rounded.

All diameters of cylindrical parts can be lapped by means of a lead wheel mounted in a cylindrical grinder. The wheel should be as small as practicable and about half the thickness of the usual wheel. It should be carefully balanced, the face and sides trued in the grinder, rebalanced, and the face retrued. The wheel speed should be the lowest obtainable on the grinder, not more than 2,000 s.f.p.m., and the work speed set at the point that shows the least vibration. The slowest possible traverse should be used. Moisten the work with aluminum oxide oil compound of either 220 or 320 grit—whichever shows the best results on trial.

The wheel is brought to the work until it presses on the abrasive. It must not be allowed to touch the surface of the work. Continue the operation until the surface is true. If a high finish is required the operation may be repeated with the same compound in 800 grit.

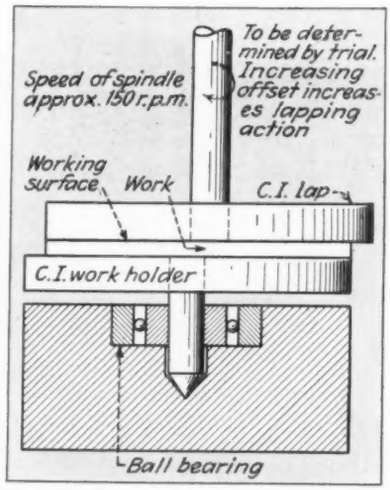
The inside of cylinders can be lapped to a much better surface than can be attained by grinding or honing. Cylinders of $\frac{3}{4}$-in. inside diameter or larger can be lapped by means of a honing head in which the abrasive sticks are replaced by whitewood sticks, or if a fast cut is desired, cast iron sticks. The bore is moistened with one of the following compounds:

For removing 0.0005 to 0.001 in. stock: aluminum oxide, 150 grit, grease.

For removing 0.0002 to 0.0005 in. stock: aluminum oxide, F grit, grease.

For removing 0.0000 to 0.0002 in. stock: aluminum oxide, FFF grit, soluble oil.

For cylinders of less than $\frac{3}{4}$-in. inside diameter, the honing type of tool can seldom be used. A satisfactory lap can be made by turning whitewood to the approximate size and splitting it lengthwise with the grain. Several thicknesses of abrasive paper or cloth are inserted in the slit, which gives the lap a barrel shape that will prevent bell-mouthing of the hole.



Flat surfaces may be lapped by mounting on a ball bearing work holder under an offset spindle holding the lap

The lap is revolved in a speed lathe at from 100 to 300 r.p.m. The cylinder is held in the hand and oscillated on the lap. The same compounds are used as for the larger cylinders.

Air cylinders for use with packed plungers need smooth walls more than great accuracy. The same compounds are used, with an expanding lap faced with leather, operating at about 700 r.p.m.

Plungers for high pressures must be free from hills and valleys, concentric and parallel, and matched to their cylinders by lapping. They are lapped in the same way as plug gages, with a split cast iron lap held by hand on the revolving plunger. They must be lapped to size, plus nothing, to provide clearance for the abrasive. Use aluminum oxide, 220 grit, grease compound.

Cylindrical and flat parts may be lapped in quantity in machines which have two parallel cast iron plates. To true the plates, run them together using silicon carbide, FF grit, oil compound. When trued, clean and run the plates together, moistening with kerosene oil.

When lapping with such a machine, apply the correct compound sparingly to the parts with a brush. From time to time add a small amount of light spindle, machine or kerosene oil to the plates. Recommended compounds:

Fast cut, matte finish: silicon carbide, FF grit, oil.

Lighter cuts, very fine matte finish: silicon carbide, FFFF grit, oil.

Light cuts, semi-polished finish: aluminum oxide, 600 grit, oil.

Very limited cuts, polished finish: aluminum oxide, 1,000 grit, grease.

If a high polish is required, after the preliminary lapping, apply the last named compound to the plates and run together until the compound is nearly dry, then insert the loaded spiders and operate without moistening.

Large, flat areas may be lapped with a circular lap of hard babbit, without grooves or flutes, having a free center bearing, preferably a ball bearing. The work is fastened to a rotating table and the lap to the tool post on a boring mill. When the table is rotated, it will rotate the lap on its center bearing.

The surface of the work is moistened with an aluminum oxide, 220 grit, oil compound, and the machine operated until the surface is smooth. The compound is then cleaned off and the surface again moistened with a finer compound, aluminum oxide, 800 grit, oil. The lapping is continued until the surface is nearly dry, when the surface is moistened with Varnoline, and again continued until nearly dry. This is repeated with Varnoline until all of the compound has disappeared.

Flat surfaces that are to be lapped on one side, can be effectively handled either individually or as companion pieces with the equipment shown in the sketch. It consists of a cast iron base on which is mounted a table which can be rotated freely on a pin. Work pieces are put on this table.

A circular cast iron lap is attached to a spindle which can be off-set from the center line of the table. The greater the offset the more rapid will the lapping process be, but the finish will not be as good as when there is less offset.

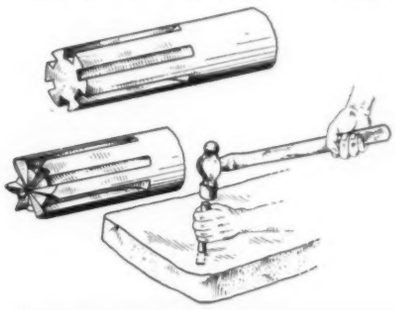
For all kinds of work, use an aluminum oxide oil compound in grits of 220, 320 or 800 depending upon the condition of the rough surface and the degree of finish desired.

The fourth and final installment of Mr. Wills' article will appear in an early number.

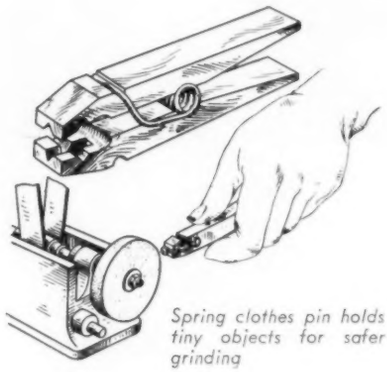
SHORT CUTS FOR THE SMALL SHOP

By A. H. WAYCHOFF

Splined auto axles make good cement drills



SPLINED AXLES and transmission shafts can easily be obtained at any auto junk yard. With a little filing these make fine rock and cement drills. Just cut off the length you want with a hacksaw, and then file across the splined end to make chisel-shaped points as shown. A large three-cornered file is about the best kind to use. The tool is used just like a star drill, and as the material in them is the best of alloy steel you have a long-lived, fast-cutting drill for either rock or concrete

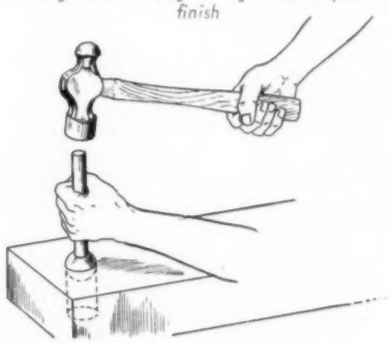


Spring clothes pin holds tiny objects for safer grinding

AN ORDINARY SPRING CLOTHES PIN makes it easier and safer to grind off the head of a small screw or bolt. Just cut a little V-groove in each jaw, as indicated in the sketch, and catch the bolt in it. Squeeze the clothespin jaws together a little so as to help the spring. With the screw head resting against the jaws, it won't slip or wobble during grinding. The wood won't hurt the threads, either, like pliers would.

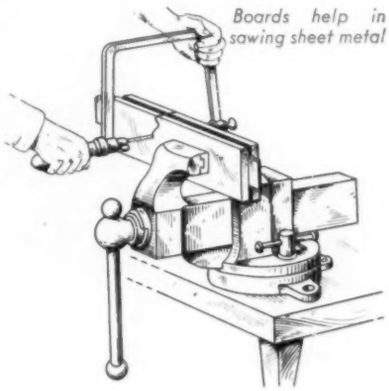
MANY TIMES after a hole has been drilled in a piece of work it is found a bit rough and impossible to use as a tight yet working fit on a shaft. When this happens you can drive a bearing ball through the hole, burnishing it in a way impossible with a reamer or drill. You should force it through with a punch or small rod having a slightly concave end so as not to strike the walls of the hole.

Driving ball through snug hole improves finish

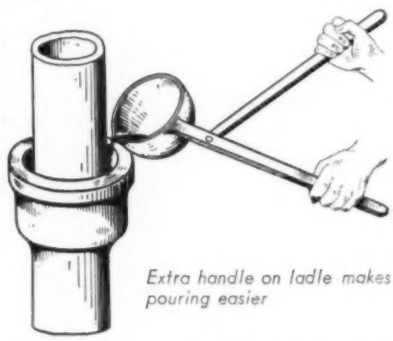


As balls are readily obtainable in measurements of thousandths, in many cases you can get a better fit for a shaft by drilling the hole and then driving the ball through, clearing up all the rough places and slightly enlarging the hole to make a perfect fit

Boards help in sawing sheet metal



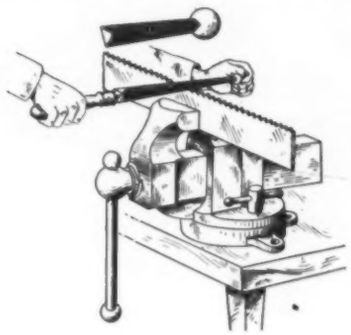
SAWING TO an accurate line in thin sheet metal can be one of the toughest jobs in the shop, but a couple of pieces of lumber make it child's play. Just clamp the sheet metal in the vise between the two boards, mark the line on the board nearest you, and start sawing. The line will be easy to follow since the saw won't catch in the sheet metal



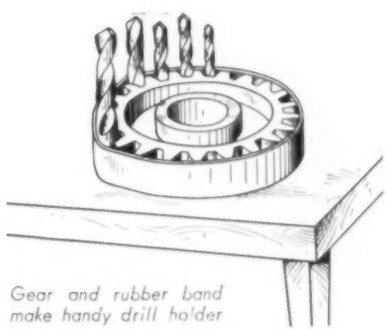
Extra handle on ladle makes pouring easier

HANDLING A MELTING LADLE holding thirty pounds or so of molten metal is no easy job no matter how strong you are. One man working alone leading pipe joints rigged up an extra handle to make the work easier. He made it from a piece of bar iron the same size as the regular handle, and attached it with a single rivet. He made this rivet pretty tight but still loose enough for him to swing the handle in under the regular one when he didn't need it. The extra handle gives quite a lot more lifting hold on the ladle, and helps in tipping it for pouring.

Rubber balls on saw file prevent cut fingers



FILING A SAW, for anyone not too experienced, usually results in a few fingers cut from snagging the saw teeth. This can be prevented by getting a couple of two-for-a-nickel solid rubber balls from the ten cent store, and driving one on the file point and the other on the tang, at the bottom of the handle. These make the file a lot easier to hold and at the same time act as bumpers, keeping the fingers away from the sharp teeth



Gear and rubber band make handy drill holder

FOR SMALL TOOLS such as taps and drills it's hard to beat a stand made by stretching a heavy rubber band around the teeth of a large gear. The tools are readily slipped between the teeth, and the stretch of the rubber lets the gear hold quite a number of sizes. By using a small, fine-tooth gear, you can get the stand to hold up to half-inch drills, with the smaller sizes held just as well

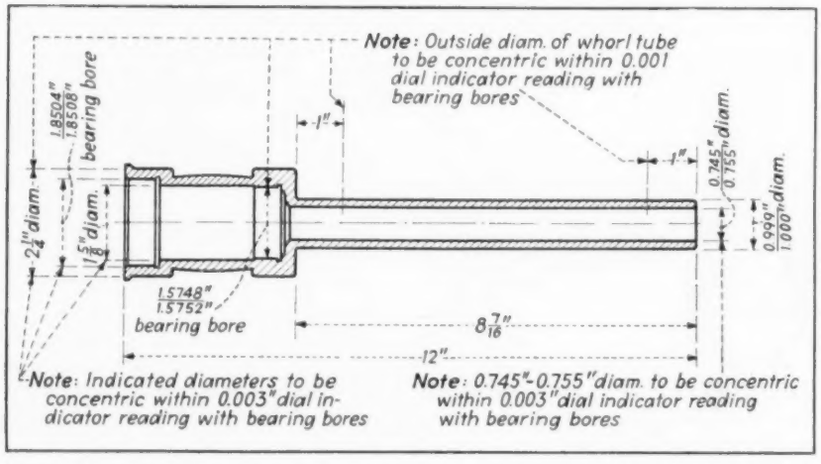
Left. First bench inspection of spindle whorls consists of checking: (1) concentricity of the big end with respect to the bearing bores, (2) concentricity of the tube at two points with respect to the bearing bores, and (3) runout of the inside diameter of the tube. Output from this set-up is 30 pieces per hour

Below. Inspection of the bearing bore diameters is economically done for the large amount of work by using Comtor expansion plug gages fitted with dial indicators

Inspection Simplified

Dial indicators ingeniously used in simple fixtures allow fast, accurate checking of thousands of close-limit parts

By L. A. COREY, *Superintendent, Rayon Machinery Corporation*

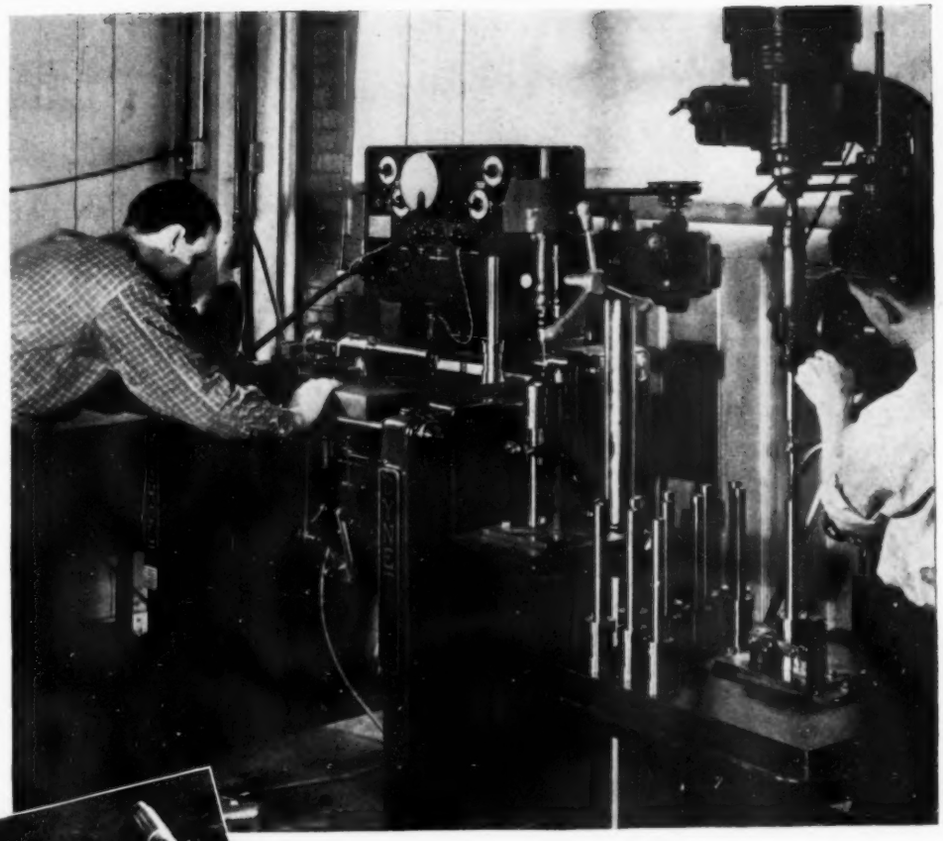

Note: Outside diam. of whorl tube to be concentric within 0.001 dial indicator reading with bearing bores
1.8504" 1.8508" bearing bore
2¼" diam.
1.5" diam.
1" 1"
0.745" 0.755" diam.
0.999" 1.000" diam.
1.5748" 1.5752" bearing bore
8 7/16"
12"
Note: Indicated diameters to be concentric within 0.003" dial indicator reading with bearing bores
Note: 0.745"-0.755" diam. to be concentric within 0.003" dial indicator reading with bearing bores

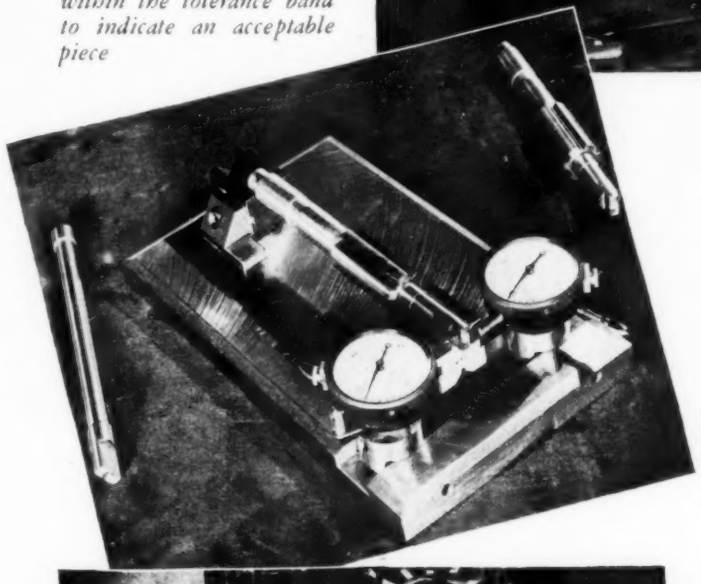
To eliminate rejections for improper running balance, spindle whorls are supplied so that tube runout with respect to the bearing bores is only 0.001 in.

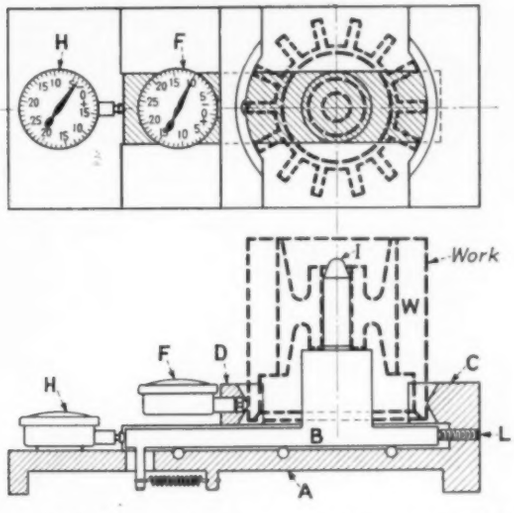
SUCCESSFUL operation of Industrial Rayon Corporation's new continuous-process spinning machine depends in a large measure on smooth rotation of the spinning, processing and drying reels and spindle assemblies. An adequate inspection department had to be set up at the subsidiary machine building plant, Rayon Machinery Corporation, to check the purchased parts for the 86,400 reel assemblies and 9,600 bobbin spindles. The magnitude of the job required fast and cheap methods of inspection, but the product demanded several checks of close limits. Equipment installed represents in each case the result of careful study of the operation involved, and was chosen after rejection of many complicated ideas.

Right. Balancing the spindle whorl to 0.002 oz.-in. is done on three machines: (1) a Gisholt Dynetric balancer for checking the amount and location of unbalance at both ends, (2) a drill press fitted with a calibrated depth feed for drilling the right amount of material from the big end, and (3) a drill press fitted with an automatic depth feed and a National Machine Tool Company cutter for milling an internal keyway in the tube end

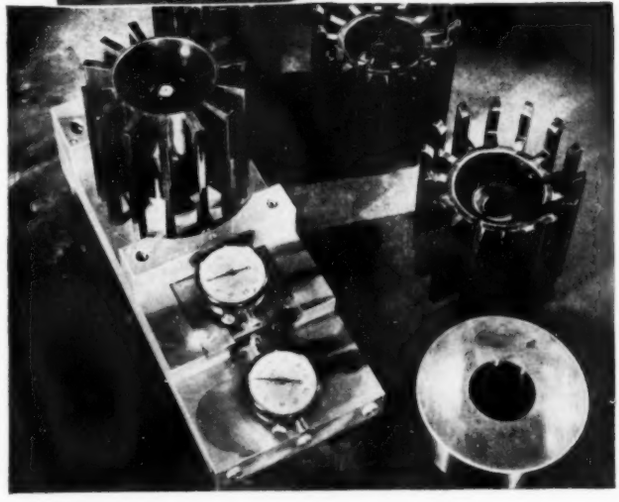
Below. Eccentricity of the driving tongue with respect to the shaft axis is checked with two dial indicators set at different heights. The tongue is inserted readily between the indicator spindles. When it is rotated so that one indicator reads zero, the other must read within the tolerance band to indicate an acceptable piece







Above. This fixture, shown in use in the photograph below, consists principally of base A and carriage B. Base A has a fixed stop C, a fixed bridge D carrying indicator F, and a rigidly mounted indicator H. Carriage B carries stud I for mounting the work, which is held in contact with stop C by a spring. To set the indicators, a master ring is placed over stud I, adjusting screw L is turned until master ring touches stop C, then indicators F and H are set to zero. In operation, the work is rotated on stud I, indicator F showing its diameter. Indicator H shows whether bore is concentric with outside diameter



Left. Outside diameter and concentricity of blades of the reel sprockets with respect to the inside diameter are determined simultaneously by using two dial indicators

IDEAS FROM PRACTICAL MEN

Fixture for Fluting Small Taps and Reamers

By HERBERT M. DARLING
Production Engineering Department, Leland-Gifford Company

A manufacturer of electrical appliances who uses a large quantity of machine-screw taps and small reamers decided to fit up a corner of his toolroom for producing them economically. Besides cutting of the blanks in a screw machine and rolling the threads on the taps, he built the fluting fixture illustrated for use in a bench-type hand miller. Blanks for nut taps, both straight and bent, having shanks smaller in diameter than the threaded parts are sent to a needle factory to have their shanks reduced by swaging.

Referring to Fig. 1, the work is held in a spring collet in the dividing head and its outer end is supported by a bushing in the bridge *A* which is attached to the knee of the machine and straddles the table. The bushing is slotted on top to admit the cutter so that the work will be well supported as it is fed through the bushing and under the cutter. The spring collet is closed by the push rod *B* which is operated by the cam *C* at the rear end of the spindle and which is pivoted to the forked end of the screw *D* for adjusting the push rod.

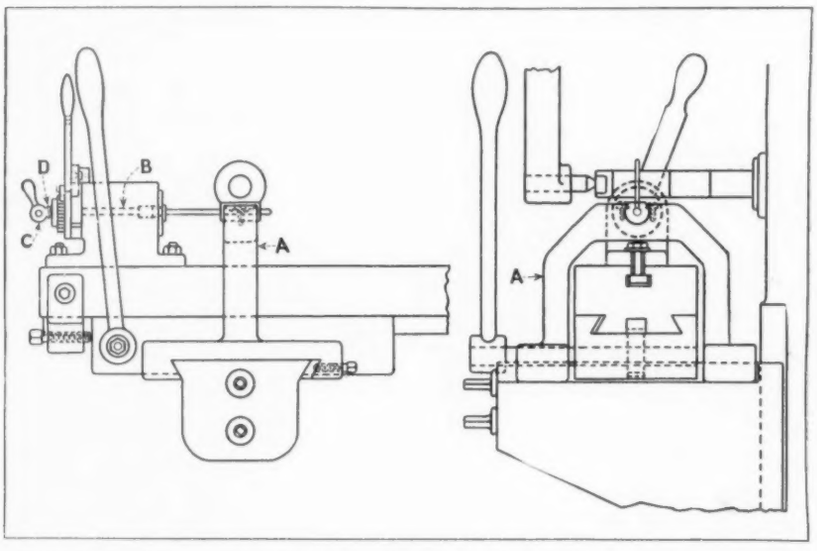


Fig. 1—Small taps can easily be fluted in this quick-acting fixture at the rate of 150 per hour by an average operator

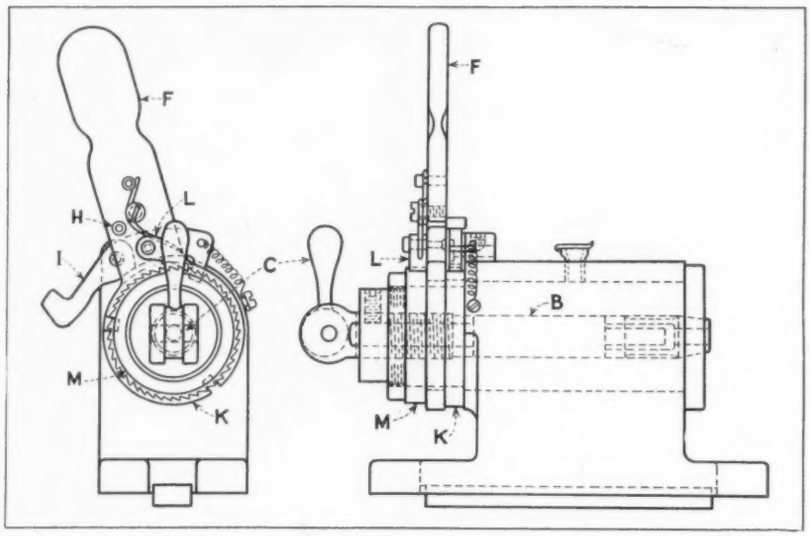


Fig. 2—Indexing is performed by a lever that disengages the index pawl from the index ring and turns the spindle until the pawl drops into the next notch

The dividing head is shown larger and more in detail in Fig. 2, and its operation is as follows: When the index lever *F* is pushed back, the pawl rider *H* depresses the tail of the index pawl *I* and disengages the pawl from the index ring *K*. When the index lever is pulled forward, the feed pawl *L* engages the ratchet *M* and turns the spindle until the index pawl drops into the next notch in the index ring. After the work has been indexed it is fed through the bushing in the bridge by the table-feed lever. The operation is repeated until all the flutes have been milled. The flutes are then ground by a bakelite wheel of the correct shape. The points of taps are ground free hand by an experienced operator.

Index rings having different numbers of notches are available. The operator uses his right hand to insert and remove the work and his left hand to close the collet and operate the index and table feed levers. The average operator can flute 150 No. 8/32 taps per hour.

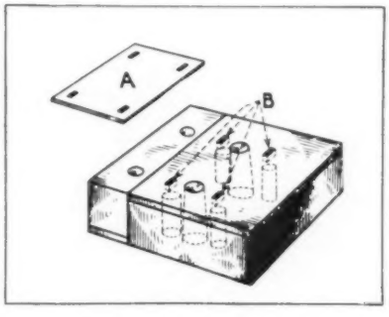
Successful Makeshift Increases Die Life

By H. R. HAGEMAN

At first the piece *A*, made of 0.030-in. half-hard brass, was produced in two-station press tools which we had decided to replace with three-station tools in order to give more room be-

tween the punches and to permit bushing the holes in the die-block. But before the new tools were started, the metal around the sides of the rectangular holes *B* in the die-block began to chip off, due to the clearance holes having been counterbored too deep from the bottom of the die-block. So that production would not be held up pending the making of the three-station tools, the following method of making repairs was used.

Taking advantage of the fact that there was still considerable length of life in the piercing punches, and that the cut-off block was separate from the die-block, a piece of commercial flat-ground steel was attached to the top of the die-block by the original screws and dowels. Impressions were made in the steel piece by the piercing punches and it was taken off and the piercing holes were finished to the outlines of the impressions. After being hardened, the steel piece was reassembled to the die-block and production was resumed. The repair was made in about one-tenth the time that would have been required to make a new die-block. The die thus repaired functioned well and by its use production was kept going until the three-station tools could be finished.

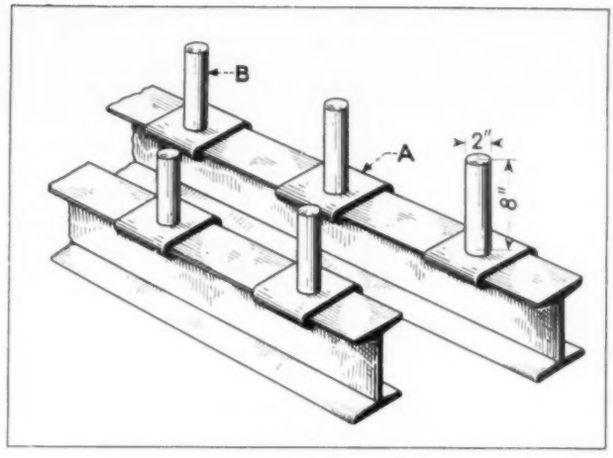


The metal around the rectangular holes having started to chip off, an auxiliary die, $\frac{1}{8}$-in. thick, was attached to the top of the die-block

Adjustable Supports for Stacks of Steel Plates

By W. J. TANGERMAN
General Superintendent
Union Metal Products Company

Ever since the introduction of pantographic flame-cutting steel plates in stacks it has been the general practice to support the stacks directly on I-beams. That, of course, has resulted in the flame cutting into the flanges of the I-beams as it cuts through the bottom plate of the stack, and finally through the flanges and into the webs, requiring frequent replacements of the I-beams.



These supports, used when flame-cutting steel plates, are placed out of the path of the torch and the flame does not reach the I-beam as it cuts through the bottom plate in the stack

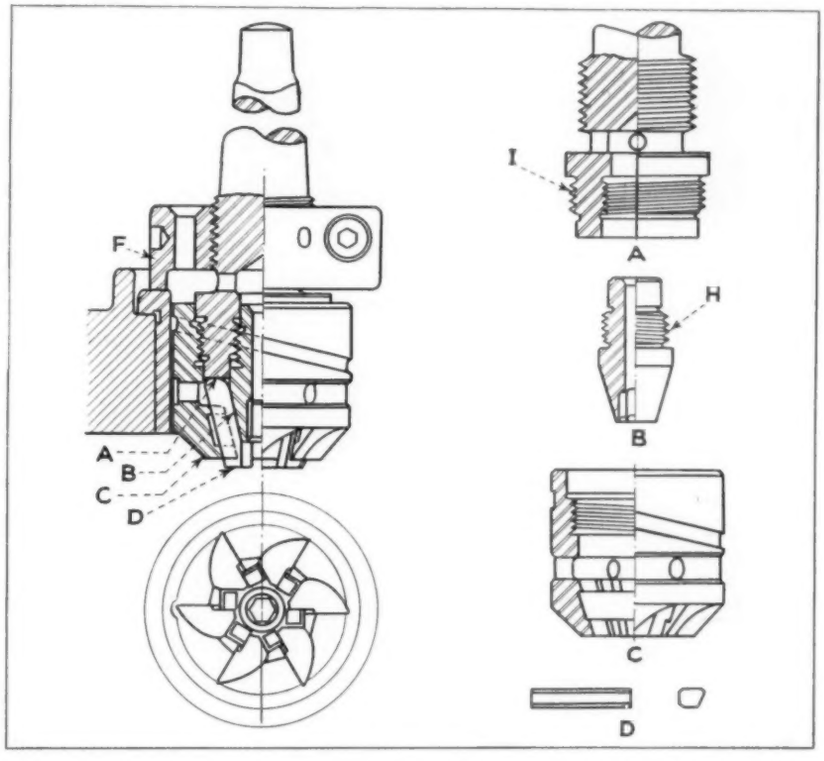
We flame-cut blanks for a number of complicated pressed shapes from $\frac{1}{4}$- and $5\frac{1}{16}$-in. plates supported on I-beams. To prevent injury to the I-beams, we developed the sliding supports illustrated. Two opposite edges of small steel plates *A* are bent around the flanges of the I-beams, but not too tightly to prevent them from sliding lengthwise on the beams. To each plate is welded an 8-in. piece of 2-in. round stock *B* to serve as a support for the stack of plates to be cut. Since the supports are placed out of the direct path of the torch they are not injured by the flame, and the flanges of the I-beams are too far below the bottom plates in the stack for the flame to reach them.

Adjustable Hollow Mill

By MAX HAAS

The adjustable hollow mill illustrated was developed for machining short lugs that had to be held within plus or minus 0.0005 in. of the specified diameter. It is used in the drill press in connection with a work-holding fixture having a guide bushing.

Essentially, the mill consists of the



Hollow mills of this type have given satisfactory service for years and have maintained their adjustment within the required limits where others have failed

shank *A*; the adjusting cone *B*; the shell *C*, all of which are made of nickel steel and are hardened and ground; the blades *D* and the stop collar *F*. The blades are inserted in slots machined in the shell and are clamped between it and the adjusting cone. Adjustment is made by turning the adjusting cone with a hex wrench inserted in a hex hole in its bottom. The blades are then lightly tapped in with a piece of copper or brass to insure their seating properly and are clamped by turning the shell with a spanner wrench.

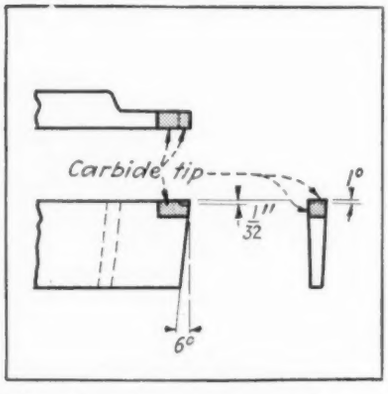
To prevent the blades from loosening during the cut, the external threads *H* on the adjusting cone and the internal threads *I* in the lower end of the shank are left-hand; thus, the tendency of the blades is to tighten under strain of the cut. To insure an adequate flow of lubricant to the cutting edges of the blades, a number of holes and channels are provided.

Parting Tool Design

By C. G. WILLIAMS

In using any parting tool, the object is to get the chip out of the scarf in the easiest possible manner. Many high-speed steel and carbide-tipped parting tools are broken because chips build up on top of the cutting edge, the chips being cut too wide to pass out through the scarf as it becomes deeper. Believing that the chip should be relieved, rather than curled or broken with a groove, I have carried out a number of experiments with carbide tipped tools for the purpose of determining the best shape to use.

The form finally selected is shown in the drawing. The slight side rake, not over 1 deg., will cause the chip to twist to one side and clear itself easily as it leaves the cutting edge. The dotted lines in this sketch indicate how a chip breaker should be ground in a parting tool if one should be needed. To give the best results, the chip breaker must be ground flat and parallel to the top of the tool. If it be given a positive top rake the cutting edge may be too thin to stand up under the stress of cutting. Set the tool so that the point of contact with the metal to be cut will be from 0.010 to 0.032 in. below the centerline and, if possible, use a power feed of not more than 0.007 in. per revolution of the work.



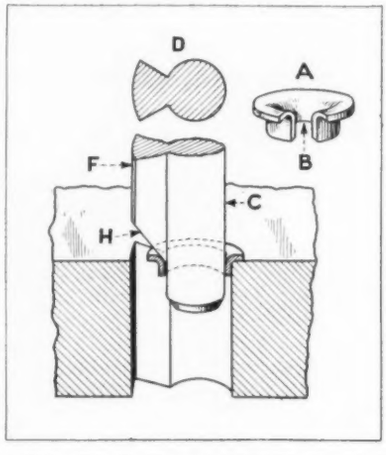
The chip will twist to one side and clear itself when the parting tool is ground as shown

Eyelets Can Be Slit Without Distortion

By L. KASPER

A large quantity of brass eyelets, one of which is shown enlarged at *A*, was required to be slit at *B*, using a punch press. The illustration shows the construction of the tools.

The hole in the die was bored to fit the shanks of the eyelets and its upper edge was rounded to fit the fillets in the undersides of the flanges. The punch *C* was rounded at its lower end to serve as a pilot, its shape above the pilot being shown by the cross-section *D*. An eyelet in position is shown in the sectional view of the die block.



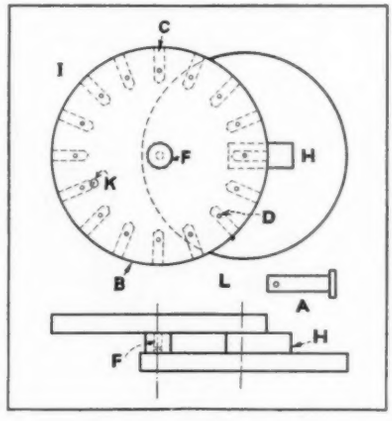
By grinding the lower end of the flared part of the punch at an angle, the eyelets were slit without distortion

Since a requisite of the job was that the eyelets were not to be distorted in slitting, experiments showed that the cut must begin at the radius joining the inside of the shank with the top of the flange, proceed downward on the shank and outward on the flange and terminate at both places at approximately the same time. Accordingly, the lower end of the flared part *F* of the punch was ground at an angle *H* to meet these conditions.

The Rapid Drilling Of Crossholes

By JOHN E. HYLER
R. G. Le Tourneau, Incorporated

The illustrated jig is useful when drilling crossholes for cotter pins in a large quantity of pivot pins, such as the one shown at *A*. The combined bushing plate and work holder *B* has sixteen radial holes *C* drilled in its periphery to serve as nests for the work, and the same number of bushed holes *D* to serve as guides for the drill. The bushing plate is pivoted on the drill-press table by a close fitting stud in the bushing *F* and is supported by the steel block *H* at the drilling position.



This drill jig, which holds sixteen pieces can be rotated so that while one piece is being drilled, a finished one is removed and an undrilled one is inserted by the operator's helper

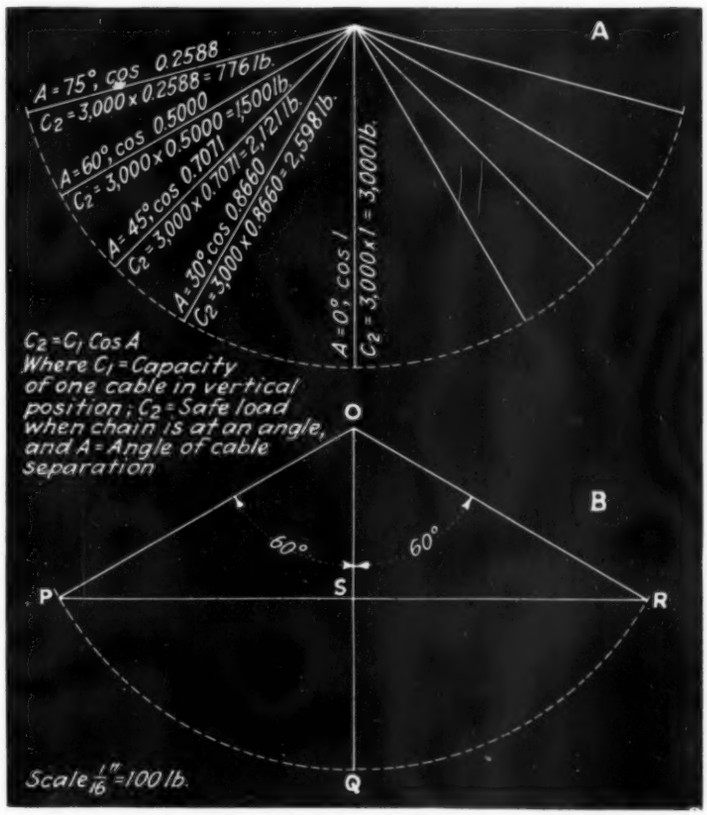
In operation, drilled pins are removed and undrilled ones are inserted in the radial holes *C* by the operator's helper who stands at position *I* and taps them lightly with a soft hammer to insure that the undersides of their heads are seated against the outer edge of the bushing plate. If the drilled pins should be too tight in their holes to be removed by hand, they can be started by a drift inserted in holes at *K*. The operator, who is at position *L*, has only to rotate the bushing plate from one guide bushing to another and attend to the drilling. Depending on drilling speeds, the jig will increase production on this job between 40 and 60 per cent.

Angular Effect of Double Slings

By C. O. HAGEN

WHEN USING double slings to lift heavy work, the fact that the angle of separation affects its capacity is often overlooked. The effects of such angles are illustrated in the accompanying sketch. At *A* the problem is solved by using a simple formula, while at *B* it is solved diagrammatically without resorting to mathematical calculations.

Assume that it is desired to ascertain the safe load on a double sling spread at an angle of 60 deg. to the vertical centerline, if the maximum capacity of the sling when in a vertical position be 6,000 lb. To solve this problem diagrammatically, we select a scale in which 1 in. represents a given number of pounds. In the problem solved at *B* in the illustration, $\frac{1}{2}$ in. represents 800 lb., that is, $\frac{1}{16}$ in. represents 100 lb. Obviously, the 3,000 lb. load on one side of the sling will be represented by a $1\frac{7}{8}$-in. line. The line *O-Q* is drawn equal to this length. From *O* draw the two lines *O-P* and *O-R*, equal in length to *O-Q* and at an angle of 60 deg. with the vertical centerline *O-Q*. From the extremities of these lines, draw the line *P-R*, intersecting the line *O-Q* at *S*. The distance *O-S*, measured to the same scale as selected, represents the load that can be safely supported on one side with the cables spread at the given angle. Measurement shows this load to be 1,500 lb.


A
A = 75°, cos 0.2588
C2 = 3,000 x 0.2588 = 776 lb.
A = 60°, cos 0.5000
C2 = 3,000 x 0.5000 = 1,500 lb.
A = 45°, cos 0.7071
C2 = 3,000 x 0.7071 = 2,121 lb.
A = 30°, cos 0.8660
C2 = 3,000 x 0.8660 = 2,598 lb.
A = 0°, cos 1
C2 = 3,000 x 1 = 3,000 lb.
C2 = C1 Cos A
Where C1 = Capacity of one cable in vertical position; C2 = Safe load when chain is at an angle, and A = Angle of cable separation
O
B
60°
60°
P
S
R
Scale 1"/16 = 100 lb.
Q

An understanding of the problems herein solved will enable a shop man to exercise his judgment better when determining the safe capacity of double slings

Like the formula for solving this problem, the diagrammatic solution is equally applicable for any angle, as proven by comparison. This article does not necessarily imply that a man should resort to figures whenever a job of this kind comes up, but it should lead to a clear understanding of the problem, thereby enabling him

CAUTIONS TO BE USED WITH CHAIN AND CABLE SLINGS

Never insert a hook into a chain link.
Never carry a load on the point of a hook.
Never overload a sling.
Never apply loads suddenly.
Never take a chance; if the sling does not look safe, scrap it.
Never hammer a sling hook into place.
Never fasten a sling over sharp corners.
Never cross, twist or kink a sling.
Never let the load rest on the sling.
Never drag a sling from under a load.
Never trust a sling that has been stretched.
Never carry an unbalanced load.
Never leave a sling or chain exposed to extreme cold.
Never apply heavy or sudden loads to an extremely cold sling.
Never be too confident of a new sling; because it is new is no reason why it should be overloaded.
Maintain constant and careful inspection.

Angular Effect of Double Slings

to exercise his judgment better when determining the safe load which can be carried on double slings.

It is obvious from the foregoing examples that the angle of separation must be considered carefully, especially when handling heavy loads. As the angle increases the safe load decreases because the tension in each leg increases. The safe loads for double-leg chain and cable slings are given in the accompanying tables.

SAFE LOAD FOR CHAIN SLINGS AT VARIOUS ANGLES OF SEPARATION

Diameter of chain stock, in.	Capacity of single leg, lb.	Safe load of double legs at various separation angles, lb.		
1/4	1,060	1,060	1,480	1,850
5/16	1,650	1,650	2,300	2,900
3/8	2,400	2,400	3,350	4,200
7/16	3,250	3,250	4,550	5,700
1/2	4,200	4,200	5,950	7,400
9/16	5,400	5,400	7,500	9,400
5/8	6,600	6,600	9,300	11,600
3/4	9,500	9,500	13,300	16,700
7/8	12,950	12,950	18,100	22,700
1	16,950	16,950	23,750	29,600
1 1/8	20,000	20,000	27,000	35,000
1 1/4	24,750	24,750	34,600	43,300
1 3/8	29,900	29,900	41,800	52,300
1 1/2	35,600	35,600	49,800	62,300
1 5/8	41,800	41,800	58,500	73,200
1 3/4	48,450	48,450	67,800	84,800
1 7/8	55,300	55,300	77,800	96,800
2	63,300	63,300	88,600	111,000

These calculations are based on wrought-iron chain stock.

SAFE LOADS FOR CABLE SLINGS AT VARIOUS ANGLES OF SEPARATION

Diameter of cable, in.	Capacity of ngle leg, lb.	Safe load of double legs at various separation angles, lb.		
1/4	1,000	1,000	1,400	1,700
5/16	1,250	1,250	1,750	2,150
3/8	1,900	1,900	2,700	3,300
7/16	2,600	2,600	3,700	4,500
1/2	3,350	3,350	4,750	5,800
9/16	4,000	4,000	5,650	7,000
5/8	5,000	5,000	7,100	8,500
3/4	7,000	7,000	9,900	12,100
7/8	9,200	9,200	13,000	16,000
1	12,000	12,000	17,000	20,800
1 1/8	15,200	15,200	21,500	26,400
1 1/4	18,800	18,800	26,600	32,600
1 3/8	22,200	22,200	31,400	38,500
1 1/2	25,600	25,600	36,200	44,400
1 5/8	28,800	28,800	40,700	50,000
1 3/4	34,000	34,000	48,000	59,000
1 7/8	38,000	38,000	53,700	66,000
2	42,000	42,000	59,500	72,900

These calculations based on Roebling cable of six strands with hemp center, 19 wires to the strand.

Where There Is Smoke

POLICEMAN, PROSECUTOR, judge and jury, all rolled into one. "Not possible in this country," you say. "They may pull that stuff in Germany and Russia, but not here."

But how about the National Labor Relations Board? That is the way it works.

For months you have heard accusations against the board and its staff, including their leanings toward the C.I.O. Employers have charged that they don't get a fair deal from the board; the American Federation of Labor also feels aggrieved at its treatment by the board.

Now comes the chance to find out the facts, to separate mere rumors from the truth, as the special House committee investigation of the board's affairs gets under way.

For one thing, the suspicion has arisen many times that board members or their regional directors were in cahoots with C.I.O. leaders. Nothing that the board has done has served to allay that suspicion.

Pay dirt was struck at the investigation's opening session. William Leiserson, looked upon as the board's ablest member, made it plain that he has a low opinion of the ability of Nathan Witt, the board's influential secretary. He referred also to the investigators attached to Mr. Witt's office as "amateur detectives."

The efforts of Mr. Witt's office to investigate the board's own regional offices have a comic opera touch. Mrs. Herrick, New York regional director, expressed indignation because these "detectives" conducted themselves like members of the Ogpu.

In one case Philip G. Phillips, Cincinnati regional director, conceded in his testimony, according to newspaper reports, that he had not properly separated the board's judicial and prosecuting functions.

And so the testimony goes. One feels a keen sense of regret that thus one of the most vital issues among our national problems, namely, labor relations, is being so bandied about. What industry and labor need is to work harmoniously together. What they need, when alone they cannot achieve that harmony, is confidence on both sides in the adjudicating board.

Any Board dealing so deeply in human relations as the National Labor Relations Board cannot succeed unless no suspicion of partisanship exists regarding its own membership or its own staff.

Let's be fair. No board ever tackled a tougher job than the N.L.R.B. did. Into its lap was dumped the responsibility for enforcing an act which most employers believed from the first was one-sided at their expense. Under the circumstances an added responsibility rested upon the board to be strictly impartial and to maintain the judicial temperament. But that hasn't been the case. Perhaps anyway it is asking the impossible to expect the same men to be prosecutor and judge. That is a fatal flaw in the Wagner Act itself.

The least that can be done, until Congress does something about changing the law, is to put on the board men in whom the public will have full confidence. There are such men and they shouldn't be hard to find.

Burnham Finney

GAGING BUSINESS

Metal-working industry will continue operations on two and three shifts straight through holiday season. First quarter production will be maintained close to present peak rate.

There will be no year-end lull in the metal-working industry. Manufacturers are so rushed with business that they will pause only momentarily for Christmas and New Year's, continuing their operations on two and three shifts straight through the holiday season. Production during the first quarter will be maintained close to the present all-time peak. The amount of business originating with the government's national defense program has been large.

MACHINE TOOLS—Output stood at 91.2 per cent of capacity during November, compared with 84.9 per cent in October, States the National Machine Tool Builders' Association. Production during December has continued at last month's record pace. Fresh orders, on the other hand, have declined in volume, particularly those from domestic buyers. For one thing, users in this country are balking at purchasing machines which cannot be delivered for six to twelve months. Many dealers see little chance of another notable spurt in domestic bookings, such as occurred in September and October, so long as the delivery situation is so bad. Several machine tool companies are building or have just completed plant additions to augment their productive facilities.

AIRCRAFT—Plane makers have benefited from another windfall of orders from the British, French and U. S. Governments. New bookings the past week are estimated at upwards of $140,000,000. Biggest single order was that placed with Douglas by the British for $60,000,000 of bombers. French have bought 650 more Curtiss pursuit planes and 270 Douglas bombers. The British have contracted for 200 Lockheed bombers at a cost of $20,000,000. Consolidated Aircraft has been awarded a $20,000,000 contract by the U. S. Navy for flying boats. Instead of catching up with orders, the industry is farther behind than ever.

STEEL—Steel sales have tapered, though still continuing at a high level. This is attributed mostly to usual year-end influences rather than to a general downward trend in demand. Automobile companies are still taking huge tonnages. Mills probably will be able to make better deliveries on most products by next month. Toledo has been established as a steel basing point by the industry.

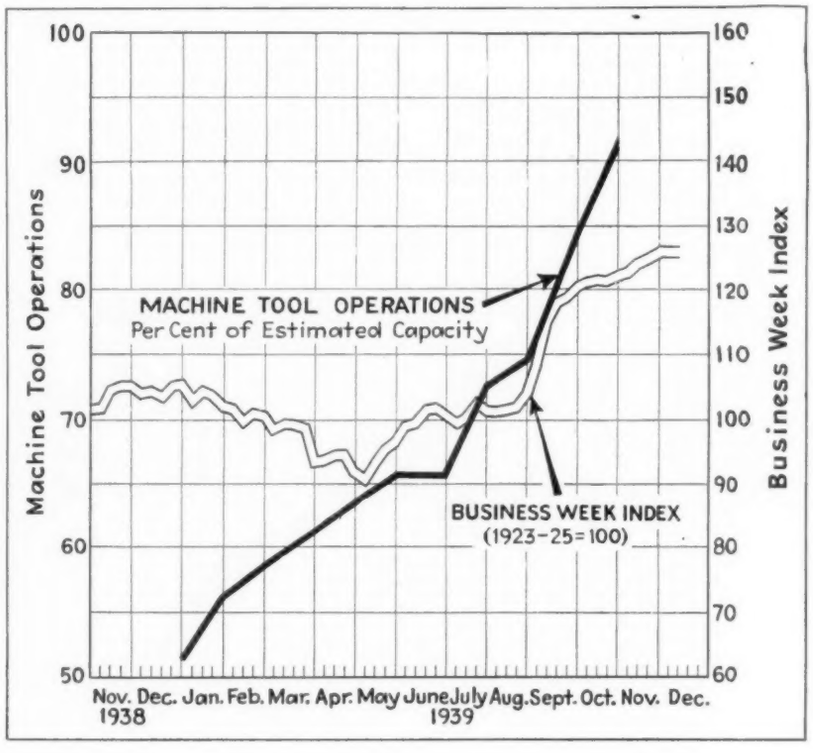
SHIPBUILDING — Already overloaded order books have been bulged further by new awards the past two weeks. The Navy has contracted with Electric Boat Co. for 11 torpedo boats and 12 submarine chasers. The Canadian war purchasing board is asking for bids until January 4 on 30 "whale catchers" (anti-submarine craft) to cost around $450,000 each. This business will keep Canadian shipyards, particularly those at Halifax and on the St. Lawrence, engaged for several months.

GEARS—November sales were 10.6 per cent below October's and 75 per cent better than those in November, 1938, according to the American Gear Manufacturers Association.

RAILROAD EQUIPMENT — Car builders have backlogs which assure capacity operation of plants until early next summer. American Car & Foundry alone has orders totaling $32,600,000, compared with $2,500,000 last May. Magor Car Corp. has contracts for 1,000 freight cars. Santa Fe has tentatively appropriated $6,776,815 for 1940 improvements; this sum should be added onto an $8,000,000 carry-over from this year. General Machinery Corp. and Davenport Besler Corp. are demonstrating a new diesel locomotive with hydraulic transmission. Locomotive builders' prospects are the best since '29. Order books are sufficient to keep plants busy until well into the third quarter of next year.

CONSTRUCTION MACHINERY —Large government projects and export business and keeping road machinery and other construction equipment people busy. The State of Texas alone has recently released orders for road construction work amounting to about $9,000,000. The Le Tourneau Co. is building an extension to its Peoria, Ill., factory and is in production of its "Tournapull" at its Georgia plant.

TRACTORS—At least three manufacturers expect to show new lines at the road show in January. Allis-Chalmers is announcing this week its new tractor powered with a General Motors diesel engine.



NEWS OF THE INDUSTRY

"CLOSING AGREEMENTS" URGED WHEN BIDDING ON GOV'T. WORK

WASHINGTON—Bureau of Internal Revenue is urging manufacturers bidding on Army and Navy contracts to seek agreement with the bureau on charging off production equipment for tax purposes before submitting bids. These "closing agreements" are negotiated by the bureau separately in each individual case, the bureau receiving from the manufacturer and from the Army and Navy their ideas of what the depreciation rates should be. The bureau, however, retains final authority.

Under a closing agreement a manufacturer doesn't get important depreciation allowance concessions, but does receive assurance that if a change in administration occurs or a new Secretary of the Treasury is appointed, he will not be liable for any subsequent increase in his tax liability unless Congress itself should change the tax laws.

Closing agreements recently have been applied to establish deductions for depreciation on new equipment utilizd by manufacturers with contracts for Navy ships or Army and Navy aircraft. Profits on such contracts are limited by the Vinson-Trammel Act to 10 per cent on shipbuilding and 12 per cent on aircraft. The bureau has yet to consider applying closing agreements to contracts for munitions outside the provisions of the Vinson-Trammel Act.

Two agreements have thus far been negotiated, one with Colt's Patent Fire Arms Mfg. Co., and the other with Consolidated Aircraft Corp. The Consolidated agreement, the more recent of the two, provides that for the period of the contract the company may charge off as an indirect factory expense the cost of tools consumed during its performance and the depreciated cost, less salvage value, of buildings which must be demolished for the company to carry out the contract.

With respect to buildings, machinery or other similar facilities which must be acquired by Consolidated to perform its contract with the Navy for aircraft, the agreement expressly refrains from fixing rates of depreciation and obsolescence, but permits the company to deduct the portion permanently discarded upon completion of the contract. Deductions allowed for new facilities and for demolition of old facilities cannot be treated as direct charges against the contract, but are to be prorated to all new work which the company may have.

The treasury will not allow any charge-off for equipment utilized in producing Army or Navy contracts but previously used in manufacture of foreign government orders. If the manufacturer hasn't covered his cost out of such foreign contracts, he is out of luck.

Bureau of Internal Revenue is opposed to granting outright tax concessions on contracts under the Vinson-Trammell Act not only because of the profits limitation imposed by that law, but because of the generous treatment afforded contractors within the limitations of the law.

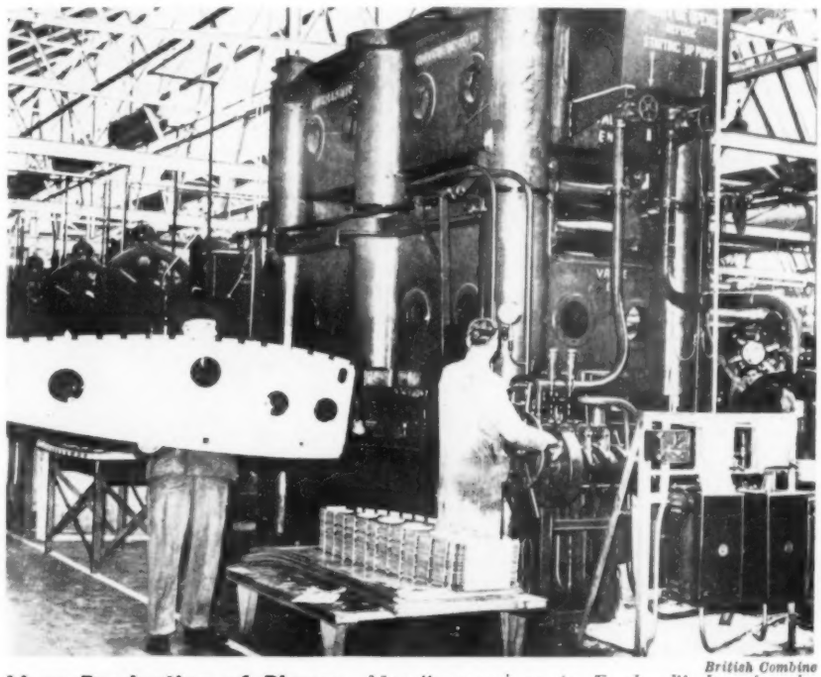
Wagner Act Revision Considered Improbable Despite Efforts of Many Who Favor Changes

Lewis Seen as Confusing Issue Rather than Actually Promoting Amendment

By BLAINE STUBBLEFIELD

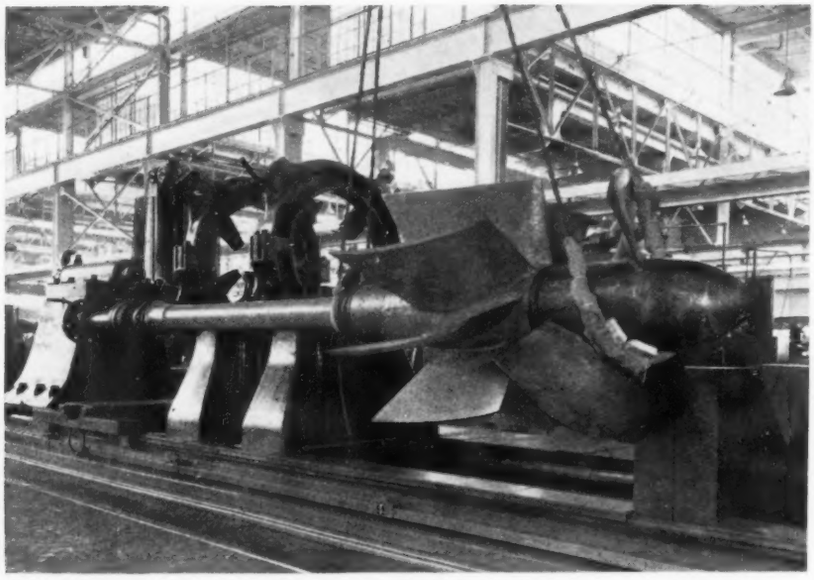
WASHINGTON—No one knows what will come of the House committee investigation of the storm-wracked National Labor Relations Board. Look at the Capitol's weather cock and you see the wind blowing in several directions.

One commentator sees revision of the Wagner Act almost certain at the next session of Congress, now that John L. Lewis, William Green and the National Association of Manufacturers want amendments and appear combined against the law as it stands. But considered more likely is the fact that Lewis is not striving for amend-



British Combine

Mass Production of Planes—*Not "somewhere in England" but in the Coventry plant of Sir W. G. Armstrong-Whitworth Aircraft, Ltd., hundreds of giant Whitney bombers are being turned out. These planes have a loaded weight of 8 tons, a wingspread of 84 feet, and a top speed of 215 miles an hour. Here wing ribs are being stamped out of sheet aluminum with a hydraulic press*



Maintenance—*"Minor repairs" to this hydraulic impeller gave the Ford tool and die shop in Dearborn some extra work recently. Six feet in diameter and over twenty feet long, it is capable of handling 157,750 gallons per minute*

ments, but is seeking to confuse the investigation in the hope of preventing any action, thus saving what he's got.

Lewis, for one thing, wants criminal penalties provided for violators. Competent observers suspect that the CIO leader has proposed this drastic action for trading purposes, hoping to stir up enough alarm among industrialists by its militant advocacy that they will be glad to let the act stay as it is without modifications. Lewis also would like to amend the act to prevent the NLRB from carving up industrial fields into crafts and to bar government contracts from employers who violate the law.

Two or three years ago Lewis' support of an amendment to the Public Contracts Law actually seemed to contribute to its defeat. The CIO vote barometer is registering cool and cloudy these days, and Lewis knows it. That fact appears to confirm the argument that he is merely tossing monkey wrenches into the works.

President Can Act

Whether or not Congress does tackle the buzz saw and amend the Act, Mr. Roosevelt will have an opportunity to do some fixing when the term of board chairman Warren J. Madden expires in August, 1940. He *could* do it *before* then by kicking Madden upstairs to a judgeship. Madden has been voting with Edwin S. Smith, against William L. Leiserson, recently appointed from the National Railways Mediation Board. Leiserson, in the opinion of neutral observers, is of a competent judicial mind who knows how to write an opinion based on evidence. The President could appoint a man who would vote with Leiserson, which might modify the CIO-AFL quarrel over Board jurisdiction, and temper what most employers believe is interference with their liberties.

It would be a mistake to expect that whatever Congress or the President may do will cure the labor relations bellyache. It is one of the most vexatious and complicated problems confronting the Administration. Which is a good reason to believe that no scalpels or strong medicines will be used in an election year.

Testimony brought out in the 8-day session until the Committee adjourned for Christmas, had little bearing on the ultimate outcome, but it did spotlight considerable dirt in dark corners, which will make good headlines next year. Leiserson revealed that he had tried to get his colleagues to fire Nathan Witt, who, as secretary of the Board, has considerable power as a sort of super-information and order man. Witt later admitted that he had advised SWOC, before the Board took jurisdiction, on how to get a ruling in the "little steel" case. His action was believed illegal.

K&T RUSHES PLANT EXPANSION

MILWAUKEE — Kearney & Trecker Corp. have under way a plant expansion and modernization program to cost several hundred thousand dollars. It includes much new machinery all of which has been bought. The new building 200x330 ft. will be completed and machinery installed in time to start production March 1.

JAPANESE MACHINE TOOL BUYING EXPECTED TO SOAR IMMEDIATELY

TOKYO—Japanese machine tool buying in the United States promises to attain big proportions after the first of the year as three factors combine to dispel the caution which Japanese importers have shown recently.

The first factor is the expiration of the U.S.-Japanese treaty of commerce Jan. 26. There is no indication yet that a new treaty will be made. The Japanese are aware of Washington's stiffened attitude toward the Chinese adventure and are prepared for the worst, which may include an embargo on implements of war as well as on machine tools needed to produce them.

A second factor is the large backlog of import applications filed with the Tokyo authorities which is rapidly increasing in value as U. S. quotations advance. Officials are beginning to realize that exchange may be saved by authorizing these imports immediately.

Finally, hopes of keeping up trade with Germany have not materialized for the Japanese. The trans-Siberian route has proved incapable of handling any sizable amounts of freight.

Before the war Germany supplied 34 per cent of Japan's imports of machine tools, aircraft and engines valued at $40,000,000 in 1938. Germany also furnished 25 per cent of Japan's parts requirements, amounting to $9,600,000. Germany had an even larger share in some other articles, notably bearing balls, steam turbines, pumps, big dynamos and electric motors, gas compressors and paper-making machines.

U. S. Government Contracts Awarded to Machine Tool Makers

(Other Metal-Working Contracts on Page 1090i)

Contractor	Gov't Agency	Commodity	Amount
Acme Machine Tool Co., Cincinnati, Ohio	Navy, War	Turret lathes	$27,074
Norton Co., Worcester, Mass.	Ordnance	Grinding machines	46,382
Landis Tool Co., Waynesboro, Pa.	Ordnance	Grinding machines	12,370
E. J. Longyear Co., Marquette, Mich.	Engineers	Drilling machines	18,246
R. K. LeBlond Machine Tool Co., Cincinnati, Ohio	Coast Guard	Lathes	10,000
Bullard Co., Bridgeport, Conn.	Ordnance	Chucking machine	37,711
Jones & Lamson Machine Co., Springfield, Vt.	Ordnance	Turret lathes	15,298
Kingsbury Machine Tool Corp., Keene, N. H.	Navy	Drilling machine	14,980
Wm. Sellers & Co., Philadelphia, Pa.	Navy	Planers	248,550
General Machinery Corp., Hamilton, Ohio	Navy	Planers	248,550
Heald Machine Co., Worcester, Mass.	Navy	Internal grinders	16,468
Kearney & Trecker Corp., Milwaukee, Wis.	Navy	Milling machines	13,885

INSIDE DETROIT

By Rupert Le Grand
DETROIT EDITOR

Automobile industry expects a thumping first quarter; predictions for 1940 point to a ten per cent gain.

DETROIT—Exceptional consumer demand in the closing months of 1939 boosted production of cars and trucks, United States and Canada, to approximately 3,700,000 units for the year. All producers showed gains of considerable magnitude, but the independents made the greatest headway.

But 1939 is now practically history. What is the outlook for 1940? The short-term view is exceptionally good. Opinions differ for 1940 as a whole. President Gilman of Packard, and others, hold the belief that the gain will amount to ten per cent, indicating a total for the year of 4,200,000 units. Other students of the situation fight shy of predictions at this season because of the situation created by the war.

Outlook Bullish

At this point, bullish factors predominate. For example, the automotive industry is not faced with operation on a 32-hr. a week basis, as was the case last January. Major producers have not revised downward production plans for January, which will be on a par with December. Curtailment for February is not expected to go beyond ten per cent, despite fewer working days. The short-term view then is exceptionally good. In the words of one authority, "the first quarter will be one of the best, if not the best, in the history of the industry." A guess at production is an output of about 1,300,000 units.

December sales were nearly equal to or in excess of similar periods in November. Field stocks are not growing rapidly and must be built up further. In regard to the "spring recession" feared in some quarters, at least two automobile economists predict that the Federal Reserve Board's index of industrial production will not drop below 115 in the early months of the year. Col. Ayres of the Cleveland Trust Co. is understood to have said that the average index for 1940 will be 110 as compared with 105 for 1939.

G. M. Sales Gain 36 per cent

Sales of General Motors cars and trucks to domestic consumers are estimated at 1,360,000 for 1939. This is a gain of 36 per cent over the 1,001,770 figure for 1938, but 14.7 per cent short of the 1,594,215 total for 1937.

Purchases by domestic consumers during the last quarter have been strong, and show no tendency to slump particularly at the close of the period. The figures are: October—110,471, November—162,881, which is an all-time record for the month, and December—estimated in excess of 150,000. Reports from divisions concerning backlogs indicate that operations will continue through January at practically the present pace.

Sales to dealers indicate the capacity of the market as against a year ago. For the first eleven months of 1939, these sales were 1,175,587 as compared with 785,158 in the same period of 1938, or a 38 per cent gain. Total commitments by dealers in the United States and Canada, and for export, were 1,335,139 for the Jan.-Nov. period. Thus, it is presumed that General Motors will account for at least 1,525,000 units during the calendar year—including United States, Canada and export.

Retail sales of the Ford Motor Co. during 1939 were 45 per cent ahead of 1938. It is believed that the year's production will exceed 900,000 units for all divisions. Demand was particularly strong during the last quarter. November was 50 per cent ahead of the same month of 1938, and November deliveries topped all similar months since 1935. Customers received 72,308 Ford and Mercury cars and Ford commercial cars and trucks. Mercury sales were up 97 per cent. The substantial increase in Ford commercial car and truck sales, which totaled 14,103 units, is considered evidence that business concerns throughout the country have a growing need for truck equipment, as reflected by an increase in general business.

Ford production was stepped up to 5,000 per day in December, and close to 100,000 cars and trucks were to have been built during the month. With demand for this producer's products taking such a sharp rise, and knowing the policy of maintaining production at an even keel, it is likely that no sharp drop in production will take place during the winter months.

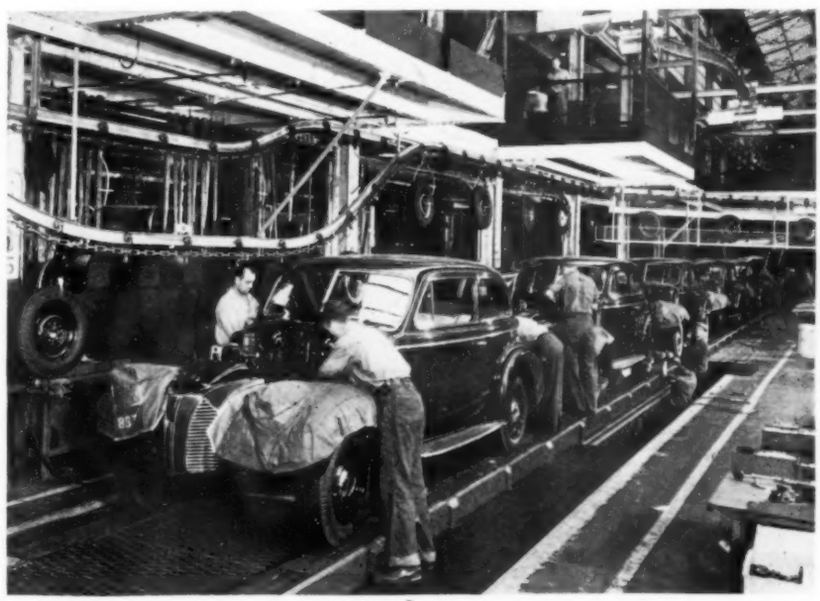
Chrysler up 30 Per Cent

Despite inability to operate its plants for eight weeks during the fall, it is estimated that production of Chrysler Corp. divisions will total over 700,000 units for the year. The gain should be approximately 30 per cent over 1938, but it might have been as much as 60 per cent had not labor trouble intervened.

Nash Up 108 Per Cent

Nash production for 1939 was officially reported to *American Machinist* as 66,244, or 108 per cent ahead of the 1938 total of 31,772. Last-quarter output reached 18,158 units as compared with 12,624 in the last 90 days of 1938.

In the first quarter, Nash expects to build cars at a slightly better rate



New Line—*Completely new last summer, this Pontiac final-assembly line is said to be the last word in efficiency. Floor grilles can be lifted to permit men to work under cars, and also provide greatly improved ventilation.*

than during the opening months of this year—21,500. Employment should be up from the 6,200 figure recently prevailing.

With a great improvement in its sales position, Nash has a better supply of new cars in the field—8,197 units as compared with 4,927 on the first of December, 1938. Used-car stocks are greater because of increased new car sales, but the total was only 14,895 as against 10,582 at this time last year. This represents, at the current rate of sales, a 40-day supply, while last year the dealers had a 51-day supply on hand.

Introduction of the "dealer council" has proved so successful that Nash dealers have average profits among the highest in the industry. Numerically, the dealer body is 5 per cent stronger, but it is financially stronger in much greater degree.

MACHINE TOOLS WANTED

NEW YORK—The Hotchkiss Co. of France is in the market for new or rebuilt American machine tools in connection with tooling up for manufacture of heavy armament for the French government. J. H. Jacobsen, Room 302, 610 Fifth Avenue, New York City, is in charge of the buying program in the United States. Included in the machines to be purchased are 18 radial drills, 24 Hendey type toolroom engine lathes, 8 vertical milling machines, 6 horizontal boring and milling machines, 10 Milwaukee type horizontal milling machines, 18 Milwaukee type vertical milling machines, 6 semi-automatic universal turret lathes, 4 vertical turning mills, 8 vertical milling machines, 10 heavy planing machines, 4 Duplex type milling machines, 4 Heald internal grinders and 1 800-ton press similar to Bliss 313A.

PLAN LEIPZIG FAIR DESPITE WAR

NEW YORK—Despite the war in which she is now embroiled, Germany will hold her usual Leipzig Trade Fair this spring. More than a score of countries are expected to send their newest industrial products to the fair, which will be held from March 3 to 10.

A new building has been added to the 42 structures previously used, making available over 4,000,000 sq.ft. of exhibition space. The 1940 spring fair will be the 1983rd session of the historic exchange which has been held without interruption for the past 700 years.

NEARLY $30,000,000 WORTH OF AIRCRAFT ORDERED BY NAVY

WASHINGTON—Navy has awarded $20,000,000 to Consolidated Aircraft, San Diego, Calif., for airplanes; to United Aircraft Pratt & Whitney Div., $7,927,000 for engines; to United Aircraft Hamilton Standard Propeller Div., $1,293,647 for propeller assemblies; to Curtiss-Wright $163,961 for propeller assemblies; to Chandler-Evans, $35,754 for fuel pumps. It is estimated the Consolidated order will involve 200 bombing planes. At the same time it is reported that Congress will be asked for 518 new coast patrol planes, in addition to those now authorized, to enforce the neutrality law. The planes would cost some $29,000,000, which would be included in the $271,000,000 which the President has requested as a deficiency appropriation to meet unexpected national defense costs arising from the European war.

SCHNEIDER-CREUSOT PLANS TO MAKE ARMAMENTS IN CANADA

TORONTO—The big French armament firm, Schneider-Creusot, will establish an armament manufacturing plant in Ontario. Just before the outbreak of war, Schneider-Creusot made an arrangement with Marine Industries, Ltd., whereby its methods and processes were to be used by the latter in the production of field guns for the British. At the same time the French concern was understood to have been given an interest in the new company formed by Marine Industries, Ltd., to fill war orders. It is believed that Schneider-Cruesot, which at one time had plants in Czecho-Slovakia and other countries, plans to concentrate much of its operations in Canada, aside from those in France. Machinery for this work will be moved from Europe, and probably some new machinery will be bought.

The Canadian tariff board is being asked to give concessions which will permit development of an airplane motor manufacturing industry in Canada, utilizing the designs and processes developed in the United States and other countries, according to reliable reports. No motors are now made in Canada except for a small radial engine made by Canadian Car & Foundry Co.

Further purchases of war supplies by the Canadian government have brought such expenditures to $54,000,000 since the war began.

FLARE AND GAS MASK ORDERS PLACED IN EDUCATIONAL PLAN

WASHINGTON—War Department's $16,000,000 educational orders program moved another step ahead last fortnight when contracts totaling $702,804 were awarded to four companies for the development of military aircraft parachute flares and gas masks. Kilgore Manufacturing Co., Tipp, Ohio, and National Fireworks, West Hanover, Mass., got the flare orders. Orders for gas masks went to Firestone, Akron, and to Johnson & Johnson, New Brunswick, N. J.

MILLIONS FOR CAR REPAIRS

LOS ANGELES—Pacific Fruit Express Co., operator of a fleet of 30,000 refrigerator cars and jointly owned by the Union Pacific and Southern Pacific Railroads, is planning to spend $10,000,000 to rebuild 2,500 refrigerator cars during the first six months of 1940. The work will be distributed among the company's shops at Los Angeles, Roseville and Colton, Calif., and at Nampa, Idaho.

For Faster Freight—*Another step in the march of diesel progress was taken when this 2,700-hp. diesel-electric freight locomotive was placed in test service on the Baltimore & Ohio Railroad. Made by the Electro-Motive Corp. in La Grange, Ill., it permits considerably faster freight schedules, and also affords a possible solution to the water supply problem encountered by western roads*

BRITISH, FRENCH, PLACE HUGE ORDERS FOR AIRCRAFT IN U. S.

NEW YORK—France has ordered 650 more Curtiss pursuit planes which have outfought German Messerchmitts on the western front, according to recent reports. The British Air Ministry also has contracted for 200 Hudson bombers from Lockheed Aircraft Corp. at a cost of $20,000,000. The original British order for these bombers, 250 in number, was completed less than a month ago.

The French have purchased 270 more Douglas bombers known as the DB-7. Finland has secured for early delivery over 40 new Brewster fighting planes of the type now on order by the U. S. Navy. In this connection Navy officials gave Finland priority of delivery. The Republic of China has awarded 50 training planes to Ryan Aeronautical Co., San Diego, Cal., at cost of $550,457.

Some of the airplane orders placed in this country by foreign governments, both before the war and since the war started, are as follows: France—850 Curtiss pursuit planes, 370 Douglas attack bombers, 200 North American trainers, 245 Martin bombers and 40 Vought dive bombers; Britain—1200 North American trainers, 450 Lockheed bombers, an unknown number of Consolidated flying boats; Canada—80 North American trainers, 15 Lockheed bombers and 15 Douglas attack bombers; Australia—100 Lockheed bombers; Sweden—134 Republic pursuit planes; and Belgium—40 Brewster pursuit planes.

The French and British are known to have ordered in the United States torpedo air flasks, powder, shell casings, trucks and automotive equipment. Purchasing missions of the Allies are still organizing large staffs and are interviewing daily representatives of many industries.

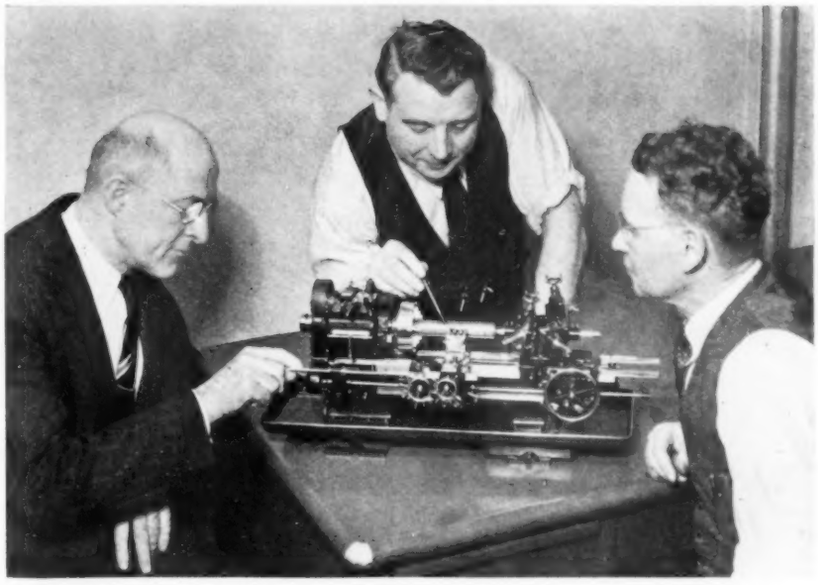
BUSINESS OUTLOOK BEST SINCE DEPRESSION, WHIPP BELIEVES

CLEVELAND—The outlook for the machine tool industry for the first quarter of 1940 is more satisfactory than at any time since pre-depression days, according to Wendell E. Whipp, president Monarch Machine Tool Co., in a statement published by *Monarch Shop Talk*, the company's plant paper.

"In the case of our own company," Mr. Whipp says, "business on the books will carry us well into the new year, and this situation is, I believe, the case to a greater or less extent throughout the machine tool industry. It is, of course, only guess-work to attempt to look past the first quarter of 1940. But it is my personal opinion that the volume of machine tool sales and production will continue at a high level for some months to come.

"I base this belief chiefly upon two factors—the strong domestic demand for machine tools by a wide variety of manufacturing enterprises, and the defense needs of the United States. Even if the foreign market for machine tools should suddenly decline . . . the need for machine tools here in our own country should still support a comparatively high rate of operations in the industry.

"Barring some totally unexpected adverse development, I believe that we in the machine tool industry are justified in assuming that we stand on the threshold of a substantial period of new development and expansion."



It Works!—*Yes, everything works on this miniature turret lathe built by Paul H. Klamm, center, Warner & Swasey planer department foreman. Representing over 1,000 hours of work, it stole the show at the hobby exhibition at the company's recent open house. Above, Mr. Klamm points out a feature to works manager William J. Burger, left, and plant superintendent Nels Swenson*

WAR SPURS BRITISH BUYING

LONDON—England has bought 183,000,000 pounds of goods in the first 80 days of the war. Purchases include 50,000,000 pounds for guns and ammunition, 50,000,000 pounds for automobiles and aircraft, 30,000,000 pounds for uniforms and equipment for soldiers, 10,000,000 pounds for machine tools, 10,000,000 pounds for scientific instruments, and 30,000,000 pounds for raw materials and general stores. The proportion of business placed in the United States was not disclosed. The business listed does not include contracts for American cotton, Russian timber and Empire rubber and lumber.

JAPANESE INDUSTRIAL EXPANSION BOOSTS DEMAND FOR EQUIPMENT

TOKYO—With self-sufficiency in machine tools as her ultimate goal, Japan continues to push industrial expansion to the limit of her productive capacity. Expansion plans now under way call for millions of dollars worth of plant installations, and as the domestic production of primary machine tools is still inadequate, American makers are assured a fairly large volume of Japanese orders for months to come.

Ikegai Iron Works has started work on construction of a plant at Mizonoguchi, Kawasaki, with official recognition as a licensed factory under the Machine Tool Manufacturing Law. Mitsui Bussan Kaisha is planning establishment of a subsidiary company with a capital of about $2,500,000 to produce a full range of machine tools. The firm will be known as Toyo Kosaku Kikai K. K. (Oriential Machine Tool Co.). Ensatsu Iron Works, a manufacturer of 6- and 8-ft. all-geared lathes and ball and roller bearings, is planning to establish a subsidiary, Ensatsu Precision Machinery Co., to specialize in bearings. Amatsuji Steel Ball Mfg. Co. has completed a new plant at Owadamura.

According to a recent investigation, the number of machine tool manufacturing plants in six industrial prefectures increased by 18 per cent, and the number of workmen employed by 53 per cent, between 1937 and 1938. Production, in terms of value, gained 30 per cent, while wages paid advanced 46 per cent.

WATCHING WASHINGTON

McGraw-Hill Washington Bureau

PAUL WOOTON, CHIEF

Spotlight remains on national defense, with increased emphasis on keeping out of the present conflict. Cost angle soft-pedaled because of coming election year.

WASHINGTON—Limited man-power but great striking force through superb mechanization seems to be this country's Army policy. Senator Elmer Thomas, chairman of the Senate appropriations subcommittee handling Army supply bills, speaking for a group of sixteen Congressmen who are touring the Army's facilities, said their opinion seemed unanimous that "the United States should not strive for the largest Army, but that we should concentrate our efforts in developing the most effective and best Army in the world." Of special interest to the metal-working industry is his prediction that military committees of both houses will recommend immediate expansion of Army anti-aircraft facilities, mass production of semi-automatic rifles, and procurement of the latest types of artillery.

Little but Mighty

Speed boats 60 to 200 ft. long, able to make 50 m.p.h., armed with torpedoes, depth charges, and light anti-aircraft guns against low-flying planes, may become important Naval inshore defense weapons. For several years England and Italy have been developing "mosquito" boats, while this country has done very little. Acting Secretary Edison now announces award of contracts to Electric Boat Co. for eleven torpedo boats and twelve submarine chasers, to be built after designs by Hubert Scott-Paine of the British Power Boat Co. Navy already has under construction four sub-chasers and eight torpedo boats designed by American manufacturers. Navy hopes that a thoroughly satisfactory speed boat can be designed in this country.

Again: Patent Investigation

Everybody who manufacturers under patents should start watching the Department of Justice and Congress again. Justice is about to launch a federal grand jury investigation of the economic use of patents, of pooling and licensing agreements "by which certain industries . . . are controlled . . . by one or several large companies." Justice is also filing suit against twelve glass manufacturers for alleged restraint of trade through patent control. Last year, seven bills revising the patent laws came before Congress. Five of them were enacted, but they were all mere procedural detail. It is feared by some industrialists that the left wing of the Administration may try to upset the whole protection principle of patent rights, by compulsory licensing or some other means. Various business and engineer groups are preparing to present the case of patent owners when Congress starts to talk.

Defense Taxes Proposed but Unlikely

At least six special taxes are proposed to "pay-as-you-go" for national defense. Congress has five and President Roosevelt one. Of course there will be more. The Congressional five: (1) A flat percentage increase in existing taxes; (2) reduction of exemptions to bring more middle-income people under the income taxes; (3) "defense profits" taxes on corporations which make more than in "normal" years; (4) special levy on profits of munitions and armaments manufacture; (5) a general sales tax. Mr. Roosevelt's model: simply raise income taxes 5–25 per cent. It will be extremely difficult to impose *any* substantial tax in the election year. Any heavy taxes would seriously cool the public ardor for more shooting irons. Nicest way out for all concerned would be more borrowing.

MORE MORAL EMBARGO

WASHINGTON—Aluminum and molybdenum have been added to the President's "moral embargo" affecting Japan and Russia. Certain plans, manufacturing rights, technical information for production of aviation gasoline, and the transfer of plants were also embargoed. All parties concerned have been notified. When the State Department "urges" you, it's tantamount to an order. The previous embargo list included airplanes, parts, motors and accessories, bombs, torpedoes. It is aimed at countries that attack civil populations from the air. Although Germany did it in Poland, she isn't on the black list because she can't get the stuff from us anyway.

Going Out of Business

The Maritime Commission is calling for bids on its last two government-owned foreign service lines, apparently in a move to get the Government completely out of the ship-operating business. The touchy situation of shipping on the belligerent seas is a consideration; somehow the sinking of a Government ship is more insulting to the flag than the destruction of a private ship. Observers here note that though the press has often accused the Administration of drifting toward federal ownership of the merchant marine, the Commission has never taken the trouble to point out, till now, that the Merchant Marine Act of 1936 *requires* it to get out of the operating business. Meanwhile, controversy goes on whether the Government should build ships while shipping is curtailed by neutrality law—with every indication, so far, that it will.

Additional Defense Developments

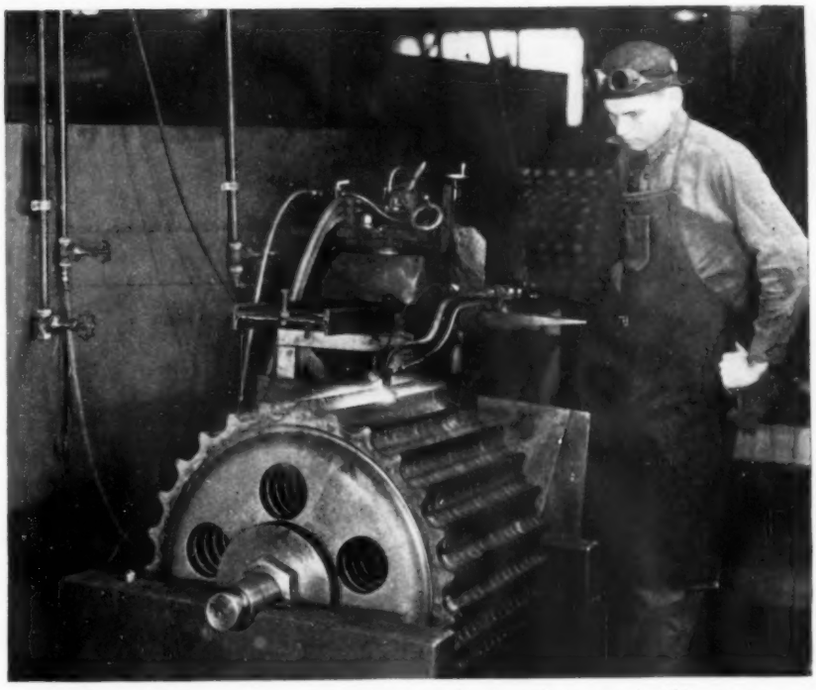
The Federal Reserve Board says that all other nations have resources convertible into American money totaling $17,400,000,000 . . . Supreme Court decision upholding Labor Board order requiring disestablishment of an independent union of Newport News Shipbuilding employees puts all independent unions on doubtful legal footing . . . Establishment of $10,000,000 credit for Finland is for non-military supplies; dealings of Finland for American airplanes are highly secretive . . . Circuit Court decision that Labor Relations Act does not prevent employers from discriminating against union or non-union men in hiring workers, means little to industry; workers have to join the union later . . . So-called "magnetic mines" could not be drawn to the hull of a ship; a compass needle arrangement, actuated by a passing ship, closes a detonating circuit. Mines are laid in shallow water, explode on the bottom, and non-compressible water carries impact to victim . . . Ninety tons of the first tin refined in this country for fifteen years has been offered to the Navy . . . WPA is said to have missed one of its greatest opportunities when it failed to include apprentice training in its program . . . FDR told press conference he knows of nothing about neutrality law changes to be proposed to Congress . . . Seems there is a clause in an old criminal code which would prevent Britain from buying ships from U. S.; Department of Justice will soon give decision on consummated French purchase, which is test case.

BRITISH COLUMBIA SHIPBUILDING EXPANDS IN HOPE OF ORDERS

VANCOUVER—In all probability the war will bring to British Columbia a shipbuilding industry which is likely to continue on a major scale long after peace is declared. Already two well known shipbuilding firms have gone ahead with construction of new ways, confident that orders for various types of vessels will be placed by Britain in the near future. During the last war British Columbia built nearly $90,000,000 worth of ships, despite her limited facilities.

Pacific Salvage Co., in North Vancouver, is rushing to completion two new 400-ft. berths at a cost of some $50,000. Each will be able to accommodate an 8,000-ton ship, and will be able to turn out three trawlers a year. A 275x70-ft. plate shed, to house the machines and materials used in constructing the ships, is being built between the ways.

Burrard Drydock, also of North Vancouver, is building two additional berths. They will be capable of accommodating two 10,000-ton ships, and will permit building four minesweepers at a time. Berths already in use can accommodate two minesweepers at once.



Gang Hardening—*Sixteen sprockets are hardened at once in this set-up used by Cleveland Tractor Company. Sprockets are clamped tightly together to insure even hardening, and slightly inclined to permit the quench water to run off. Traveling 7 in. per min., the specially made torch head produces a $\frac{1}{8}$–$\frac{3}{16}$-in. depth of case in the S.A.E. 1045 steel. Resulting hardness is 70 Scleroscope*

U. S. Government Contracts Awarded to Metal-Working Firms

(Machine Tool Contracts on Page 1090d)

Contractor	Gov't Agency	Commodity	Amount
Edge Moor Iron Works, Inc., Edge Moor, Del.	Navy	Slides, carriages base rings	$127,100
Messinger Bearings, Inc., Philadelphia, Pa.	Navy	Roller paths	74,623
Budd Wheel Co., Detroit, Mich.	Ordnance	Shells	375,996
Treadwell Construction Co., Midland, Pa.	Panama Canal	Tracks, accessories	320,000
Kline Manufacturing Co., Columbus, Ohio	Air Corps	Armament equipment	30,142
Scovill Manufacturing Co., Waterbury, Conn.	Treasury	5¢ Blanks	107,000
International Business Machines Corp., New York, N. Y.	Procurement	Verifiers	33,000
Electric Products Co., Cleveland, Ohio	Navy	Motor-generator sets	36,833
Heintz & Kaufman, Ltd., South San Francisco, Calif.	Signal Corps	Radio receivers	89,188
J. H. Bunnell & Co., Brooklyn, N. Y.	Signal Corps	Time interval apparatus	30,236
Rubicon Co., Philadelphia, Pa.	Maritime Commission	Energy meters	30,917
United Aircraft Corp., Hamilton Standard Propellers Div., E. Hartford, Conn.	Navy	Propeller assemblies	82,281
United Aircraft Corp., Pratt & Whitney Aircraft Div., E. Hartford, Conn.	Coast Guard, Navy	Aircraft engines	28,959
Service Tool & Engineering Co., Dayton, Ohio	Air Corps	Gun sight assemblies	32,725
Bendix Aviation Corp., Bendix Products Div., South Bend, Ind.	Air Corps	Carburetor assemblies	56,284
Pioneer Instrument Div., Bendix Aviation Corp., Bendix, N. J.	Navy	Sextants	42,784
Crane Co., Chicago, Ill.	Navy	Pipe fittings	77,613
Pressed Steel Tank Co., West Allis, Wis.	Navy	Afterbody shells	24,876
Heintz Manufacturing Co., Philadelphia, Pa.	Navy	Doors, hatches	81,011
Bethlehem Steel Co., Bethlehem, Pa.	Engineers	Trash racks	84,546
Aluminum Cooking Utensil Co., New Kensington, Pa.	QMC	Field range equipment	93,944
Riverside Metal Co., Riverside, N. J.	Treasury	1¢ Blanks	81,750
S. Morgan Smith Co., York, Pa.	Interior	Hydraulic turbines	753,463
Ingersoll-Rand Co., Painted Post, N. Y.	Panama Canal	Machinery	213,512
International Postal Supply Co., Brooklyn, N. Y.	Post Office	Canceling machines	31,875
Aero Spark Plug Co., New York, N. Y.	Navy	Spark plugs	117,448
RCA Manufacturing Co., Camden, N. J.	Coast Guard	Radio receivers	28,875
General Motors Corp., Delco Appliance Div., Rochester, N. Y.	Ordnance	Control equipment	236,534
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.	TVA	Circuit breakers	28,240
United States Motors Corp., Oshkosh, Wis.	Signal Corps	Panel Power Unit	34,564
Lockheed Aircraft Corp., Burbank, Calif.	Navy	Airplane	117,668
Bethlehem Steel Export Corp., New York, N. Y.	Panama Canal	Barge hull	141,000
Fargo Motor Corp., Detroit, Mich.	QMC	Trucks	8,097,345
Yellow Truck & Coach Mfg. Co., Pontiac, Mich.	QMC	Trucks	3,058,265
Bendix Aviation Corp., Eclipse Aviation Div., Bendix, N. J.	Air Corps	Starter assemblies	191,836
S. S. White Dental Mfg. Co., Philadelphia, Pa.	Medical Corp.	Dental equipment	62,836

RECORD GAGE BLOCK SALES POINT TO GREATER ACTIVITY

DEARBORN, Mich.—Sales of Johansson gage blocks during October and November reached the highest point since May, 1929, it has been revealed by the Johansson Div. of Ford Motor Co. Increased sales of the gages, according to company executives, not only indicate satisfactory current industrial activity but also reflect confidence of manufacturers in continued high levels of production.

WON'T SELL TO SOVIET

NEW YORK—Because Soviet planes bombed Finland, the Madison-Kipp Corp., Madison, Wis., has cancelled orders for $15,000 of machinery and has returned $5,000 already paid by Russian officials. Commenting on this action, Thomas E. Coleman, president, said, "Our machinery can be adapted to the production of munitions, and short of repudiating a contract, we are not going to ship such machinery to nations that bomb the civilians who are their next door neighbors."

Soviet purchases of all products in the United States during October totaled over $6,000,000. That compares with $15,000,000 in September. The figure for September, however, includes some $4,000,000 for rolling mill machinery.

FRANK H. IRELAN

PAUL H. RUTHERFORD

B. A. BROWN

PERSONALS

FRANK H. IRELAN, former production manager Delco Products Div. of General Motors Corp. and for the past several years general manager of the Delco Brake Div., has been appointed general manager of Delco Products. He succeeds CARL H. KINDL, whose resignation becomes effective Dec. 31. B. A. BROWN, factory manager of Delco Products, will become general manager of Delco Brake, succeeding Mr. Irelan. PAUL H. RUTHERFORD, present chief engineer at Delco Products, becomes factory manager. EDWIN F. ROSSMAN, assistant chief engineer, replaces Mr. Rutherford, while CALVIN J. WERNER becomes assistant chief engineer.

Mr. Irelan returns to Delco Products to take over the highest post in the organization in which he started as a laborer nearly 25 years ago, when he obtained a job in the factory of the old Dayton Engineering Laboratories Co. in Dayton, Ohio, predecessor of the present Delco Prod ucts. After a succession of promotions he was made production manager in 1925, and in 1937 was transferred to Delco Brake as general manager.

Mr. Brown's experience closely parallels that of Mr. Irelan. He began work with Dayton Engineering Laboratories in 1913 as an assembler in the factory. Thereafter he became successively an inspector, foreman, general foreman, assistant chief inspector and chief inspector. In 1936 he became factory manager.

Mr. Rutherford joined the Delco organization in 1926 as an engineer to develop fractional-horsepower motors. In 1936 he was made chief engineer, a position he has held until his recent promotion.

LOUIS H. BRENDEL has been appointed assistant to C. H. BUTTERFIELD, general sales manager of Manning, Maxwell & Moore, Inc., Bridgeport, Conn. Mr. Brendel will supervise sales promotion for the Ashcroft American Gage Div., the Consolidated Safety Valve Div., the American Schaeffer & Budenberg Instrument Div., and the Hancock Valve Div.

HARRY L. BOLTON has been elected president of Breeze Corp., Newark, N. J., succeeding JOSEPH L. MASCUCH, resigned.

H. J. BRAUN has been appointed sales head of the Steel Specialties Div., Foote Bros. Gear & Machine Corp., Chicago, Ill., in charge of "Five Point Deephard" steel products and precision gearing, replacing H. G. HOBBS.

CLARENCE G. STOLL, since 1938 vice-president in charge of operations of the Western Electric Co., New York, N. Y., has been elected president. He succeeds EDGAR S. BLOOM, who will retire Dec. 31 to become director of purchases for the British Purchasing Commission in New York City.

Mr. Stoll first became associated with Western Electric when he entered its student training course in 1903 at the Chicago shop. By 1908 he had advanced to engineer of methods, later to become head of the manufacturing branch at New York. Summoned abroad in 1912, he acted as shop superintendent of the company's Antwerp factory until the World War forced the shop to close. Returning to the United States, he rose through various supervisory posts in manufacturing and technical operations at the company's Hawthorne works in Chicago, and in 1923 was placed in charge of that works. Three years later he came to New York and was elected vice-president in charge of manufacturing, and a director. Since 1928 he has directed all Western Electric operations.

RALPH F. COHN, former vice-president Pines Winterfront Co., Chicago, Ill., manufacturer of automotive accessories, has been elected president, succeeding BENJAMIN F. STEIN, resigned.

M. R. CROSSMAN has joined the staff of the Machine & Small Tool Div., Barber-Colman Co., Rockford, Ill., in charge of advertising and publicity.

ROBERT E. DILLON, president Lake Erie Engineering Corp., Buffalo, N. Y., has been elected a director of the Marine Trust Co. of that city.

DONALD W. DOUGLAS, president Douglas Aircraft Corp., Santa Monica, Calif., has been selected to receive the 1939 Daniel Guggenheim Medal, "for outstanding contributions to the design and construction of transport airplanes," at the meeting of the Institute of Aeronautical Science next January.

FREDERICK M. FEIKER, formerly vice-president and editorial director of the McGraw-Hill Publishing Co., New York, N. Y., and more recently executive secretary of the American Engineering Council, has resigned the latter position to become Dean of the School of Engineering of George Washington University. He succeeds JOHN R. LAPHAM, whose death occurred in October.

R. L. FORNEY, assistant to the managing director of the National Safety Council, has been appointed director

EDGAR S. BLOOM

CLARENCE G. STOLL

of the council's Industrial Div., effective Jan. 1. He will replace W. DEAN KEEFER, who ended 21 years with the council to join the Lumbermen's Mutual Casualty Co. as assistant to the vice-president in charge of safety engineering.

HENRY R. FOX has been appointed Chicago field engineer for Despatch Oven Co., Minneapolis, Minn.

GEORGE A. HARRINGTON, former vice-president and general manager Robeson Cutlery Co., Rochester, N. Y., has been appointed manager and general purchasing agent of Shick Dry Shaver, Inc., Stamford, Conn.

J. F. HARTLIEB, executive vice-president Continental Can Co., New York, N. Y., has been elected president. He succeeds O. C. HUFFMAN, who has been elected chairman of the executive committee of the board of directors. C. C. CONWAY, chairman of the board, has resigned as chairman of the executive committee, but will continue to serve as board chairman.

Mr. Hartlieb joined Continental Can in 1927 as assistant to the president. The following year he was elected vice-president, and a year later became a director. In 1934 he was chosen as a member of the executive committee of the board, and in 1936 became executive vice-president.

WILLIAM HARTMAN, for 50 years with the National Cash Register Co., Dayton, Ohio, has resigned as vice-president. He will continue as a director.

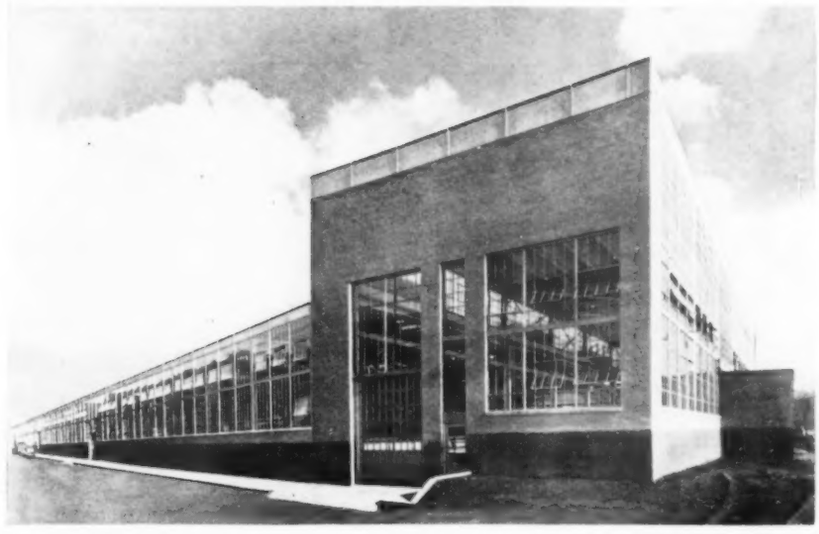
A. B. HOEFER has been appointed eastern district manager for the Udylite Corp., Detroit, Mich., with headquarters in New York City. He replaces W. L. CASSELL, resigned. L. J. GEORGE, sales engineer in the Cleveland office, has been transferred to New York.

R. L. JOHNSTONE has been appointed manager of the Shaker Div. of Ajax Flexible Coupling Co., Westfield, N. Y.

CHARLES R. STEVENSON was elected president of the Association of Consulting Management Engineers at its recent meeting in New York City. Also elected were GEORGE S. ARMSTRONG, EDWIN G. BOOZ and ALONZO FLACK, vice-presidents; and ELWOOD HORTON, treasurer.

GERARD SWOPE, who is retiring Dec. 31 as head of the General Electric Co., Schenectady, N. Y., has been appointed a member and elected chairman of the New York City Housing Authority.

C. H. VAUGHN, Birmingham, Ala., has been appointed southeastern representative for Allegheny-Ludlum Steel Corp., Pittsburgh, Pa.



Open for Business—*Just completed, this Allis-Chalmers plant in Pittsburgh is claimed to be the only transformer factory in the world laid out and set up for line-production operation throughout. Identified as the River Plant of the Pittsburgh Works, it will be used to make distribution transformers*

BUSINESS ITEMS

Ace Wire & Iron Works, Inc., has been organized in Los Angeles, Calif., with a capital stock of $25,000.

Airplane Mfg. & Supply Corp., Glendale, Calif., will acquire from Earl Herring an option agreement with Bendix Aviation, Ltd., to buy Pacific Airmotive and Airplane Parts & Supplies, two divisions of Bendix, and will engage in business formerly conducted by the two divisions.

Allen-Bradley Co., Milwaukee, Wis., has appointed PAUL BERRY, Oklahoma City, Okla., and A. V. SORENSEN, Omaha, Neb., as distributors.

Armco Culvert Manufacturers Association, Middletown, Ohio, has changed its name to Armco Drainage Products Association.

Boeing Aircraft Co., Seattle, Wash., has completed arrangements to lease the plant of the Fisher Body Corp., located on a 16-acre tract adjacent to Boeing Plant No. 2. Increasing the company's factory space by one-third, the new addition will be used mainly for sub-assembly work.

Congress Tool & Die Co., Detroit, Mich., has awarded contract for a 20,000-sq.ft. plant. Of unusual modern design, it will represent an investment of approximately $150,000 for building and equipment.

Curtiss Propeller Div., Curtiss-Wright Corp., Clifton, N. J., has awarded contract for the erection of an 11,000-sq.ft. addition to its present plant. Project marks the second expansion this year of Curtiss Propeller's plant in Clifton.

Cummins Engine Co., Columbus, Ind., has awarded contract for the design and construction of a 10,000-sq.ft. research and development laboratory.

Ex-Cell-O Corp., Detroit, Mich., has awarded contract for an 11,000-sq.ft. addition to its plant.

First National Co., Hawthorne, Calif., has completed plans for construction of a three-unit extension to its aircraft manufacturing plant. Land, buildings and equipment will cost approximately $1,000,000. First unit of the new structure will house the Olmstead-Stile Aircraft Parts Div.

Fruehauf Trailer Co., Detroit, Mich., manufacturer of truck bodies and trailers, is planning manufacture of a deluxe line of stainless steel commercial trailers. Arrangements have been completed with the Edward G. Budd Co., Philadelphia, Pa., for the use of its shot-welding process. Capable of hauling a twelve-ton load, each new stainless steel unit will weigh only about 5,000 lb. instead of the usual 7,000–8,500 lb. of the conventional design.

Hartford Machine Screw Div., Standard Screw Co., Hartford, Conn., has purchased a part of the plant of the Pratt & Whitney Div., Niles-Bement-Pond Co., adding 78,000 sq.ft. of floor space.

Lockheed Aircraft Corp. has purchased the Continental Aeronautic Corp. plant at Burbank, Calif., and is

planning to transfer all manufacturing operations of Vega Airplane Co., a subsidiary, to this location.

Iron & Steel Products, Inc., Chicago, Ill., has closed its Tulsa, Okla., branch office.

Pacer Aircraft Co. has been organized in Los Angeles, Calif., with a capital stock of $500,000.

Perfex Corp., Milwaukee, Wis., manufacturer of engine cooling radiators, is planning a $75,000 addition to its plant.

Precision Bearings, Inc., has been organized in Los Angeles, Calif., with a capital stock of $45,000.

Square D Co., Detroit, Mich., will absorb the Kollsman Instrument Co., Elmhurst, L. I., N. Y. subject to stockholders' approval. Kollsman, maker of aviation instruments, will become a Square D division, but will retain personnel and plant. It gains a larger sales organization and larger research facilities. Square D will get greater diversification in instrument manufacture, certain Kollsman items being susceptible to mass production. The question of expansion of Square D facilities has not yet been decided.

Stolper Steel Products Co., Milwaukee, Wis., manufacturer of automotive sheet metal parts, has acquired the former Cream City Bedding Co. plant, which it is remodeling at a cost of about $25,000 for warehouse and manufacturing purposes.

Transport Mfg. Co., Ltd., will build a new factory in Glendale, Calif., to manufacture a newly developed bimotor transport plane.

Utility Hardware Corp., Brooklyn, N. Y., has purchased most of the machinery and dies of Utility Mirrors, Inc., and will continue to manufacture the "Utility" line of hardware.

Van Keuren Co., Watertown, Mass., has moved into its new plant at 176 Waltham St. Designed to give increased production facilities for its line of precision measuring tools, the new plant includes a modern air conditioning heating system to provide ideal conditions for precision manufacturing.

Vultee Aircraft Co., Downey, Calif., will erect a new engineering building and install $200,000 worth of equipment which will more than double the capacity of the plant.

Wheelco Instruments Co., Chicago, Ill., has appointed Rogers Engineering Co., Dallas, Tex., as its representative for the North Texas territory.

OBITUARIES

FRITZ JOHN FRANK

FRITZ JOHN FRANK, president of the Iron Age Publishing Co., died Dec. 8 at Mt. Kisco, N. Y., following a short illness. He was 68 years of age.

Born in Emporium, Pa., Mr. Frank attended Rollins College, Winter Park, Fla., receiving the degree of Bachelor of Arts in 1896. He soon began his publishing career by joining the *Colliery Engineer* (later *Mines and Minerals*) as advertising manager. In 1902 and 1903 he made a tour of the world investigating possible markets for American machinery. In 1906 he joined *The Mining and Scientific Press* as Chicago representative, continuing with that publication until 1910, when he went with *The Iron Age* as advertising manager in the New York territory. A year later he was made secretary of the David Williams Publishing Co., predecessor of the Iron Age Publishing Co., and in 1918 was elected vice-president. The following year he became its president and occupied that position until his death.

In addition to his executive positions with *The Iron Age*, Mr. Frank was also executive vice-president of the Chilton Co., and held directorships in the Robbins Publishing Co., the Business Publishers International Corp., the Newton Falls Paper Co. and the Savage Arms Co. He was also a member of the Engineers Club of New York and a past president and governor of the Machinery Club of New York.

ROBERT G. BOOTH, 75, founder R. G. Booth & Co. and Bridgeport Wire Works, Bridgeport, Conn., died Dec. 6.

GEORGE L. BUCK, 73, founder and retired president of the Racine Iron & Wire Works, Racine, Wis., died Dec. 6 at his home in that city.

ALBERT A. HASSELQUIST, 76, who organized the Elgin Tool Works, Elgin, Ind., died Dec. 10.

ARTHUR O. A. FOX, 84, founder of the Northern Electric Mfg. Co., Madison, Wis., died Dec. 11 of injuries received in a fall.

HARRY FRIEDMAN, 74, former president American Iron & Steel Co. and executive vice-president Cohoes Rolling Mills, Cohoes, N. Y., died Nov. 28 in Miami, Fla.

FRANK LUDLAM, 66, assistant secretary and assistant treasurer of the International Nickel Co., New York, N. Y., died Dec. 8 at his home in that city following a long illness.

JOHN F. G. MILLER, 63, vice-president B. F. Sturtevant Co., Boston, Mass., died at his home in Brookline, Mass., on Dec. 9.

DON P. O'KEEFE, purchasing agent for the Chevrolet Div. of General Motors Corp. and for eighteen years associated with Chevrolet, died Dec. 18 in Detroit, Mich., following an extended illness. He was 57 years of age.

MAJOR MICHAEL F. OWENS, 64, for over 30 years general manager of the Automatic Refrigerating Co., Hartford, Conn., died Dec. 10 at his home in that city.

GEORGE E. THOMAS, 65, president and general manager of the La-France Fire Engine & Foamite Co. of Canada, Toronto, Ontario, died Dec. 9.

MEETINGS

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Winter meeting, Columbus, Ohio, Dec. 27–Jan. 2.

AMERICAN ENGINEERING COUNCIL. Annual meeting, Mayflower Hotel, Washington, D. C., Jan. 11–13.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Winter convention, New York, N. Y., Jan. 22–26.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Annual meeting, Blackstone Hotel, Chicago, Ill., Jan. 16–18.

CANNING MACHINERY & SUPPLIES ASSOCIATION. Annual meeting, Stevens Hotel, Chicago, Ill., Jan. 22–26.

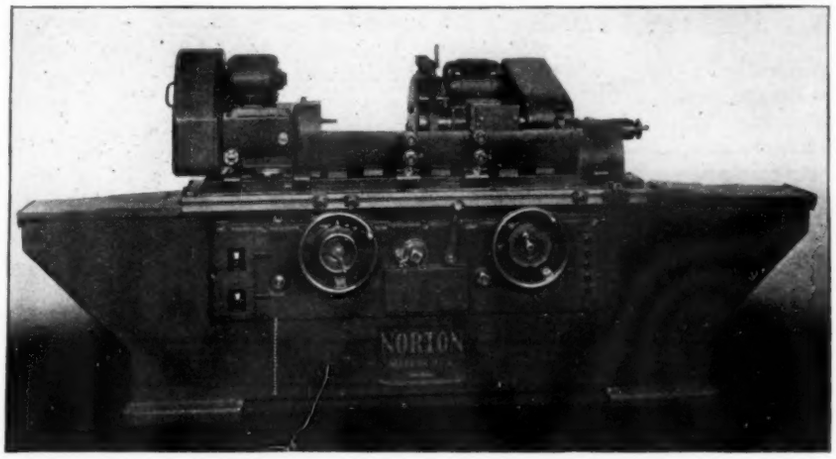
INSTITUTE OF SCRAP IRON & STEEL. Annual meeting, William Penn Hotel, Pittsburgh, Pa., Jan. 9–11.

SOCIETY OF AUTOMOTIVE ENGINEERS. Annual meeting, Book-Cadillac Hotel, Detroit, Mich., Jan. 15–19.

WASHER & IRONER MANUFACTURERS ASSOCIATION. Annual meeting, Chicago, Ill., Jan. 10.

SHOP EQUIPMENT NEWS

Norton "Multipurpose" Universal Grinder Used for External and Internal Operations



The 12-in Type LC "Multipurpose" universal grinder announced by Norton Company, Worcester, Mass., can be used for both live-spindle and dead-center operations. The change from one type of drive to the other is accomplished by adjusting a knob on the front of the headstock. Base of the unit is graduated and can be set at any desired angle to either side of the zero, or normal position. Being a universal machine, external and internal grinding operations can be performed with equal ease.

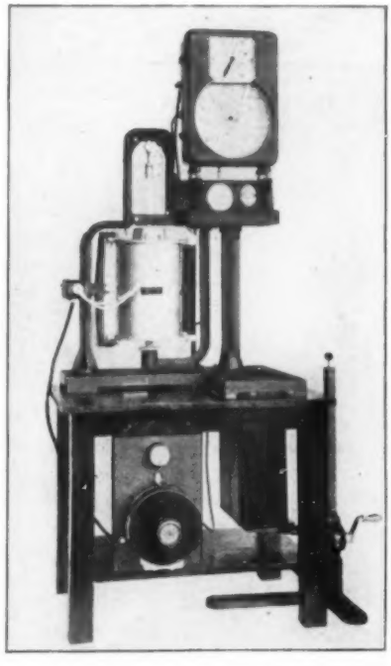
The table can be propelled either hydraulically, or by hand through a two-speed arrangement, thus making it possible to move the table quickly into position or more slowly for shoulder grinding and similar operations. When the power traverse is engaged, hand traverse is disengaged and vice versa. The wheel-feed mechanism has two ranges of feed; each hole in the index is equivalent to a work diameter reduction of 0.0004 in. in the fast range and 0.0001 in. in the slow range. An electric dwell control for the hydraulic traverse enables the operator to adjust the amount of dwell at each table reversal within a fraction of a second.

The headstock is driven by either a ½-hp. constant speed a.c. or an adjustable-speed d.c. motor. Cone-type vee pulleys provide four work speeds ranging from 65 to 260 r.p.m. when an a.c. motor is supplied. In either case work revolution is pushbutton controlled.

The wheelslide can be swiveled to any desired angle and fed at this angle, or it can be set at any angle and fed perpendicularly to the table ways. Another feature of the wheelslide is its quick adjustment. By releasing a single binding screw, it is possible to move the wheel unit proper backward or forward, thus increasing the distance between wheel and work centers by as much as 6 in. if desired. This feature is of advantage when grinding with the headstock swiveled 90 deg. toward the wheel. The machine swings 12 in., and is built in 24, 36, 48, and 72 in. lengths. Its weight ranges from 5,000 to 7,000 lb.

Steel Tested With Bristol Dilatometer

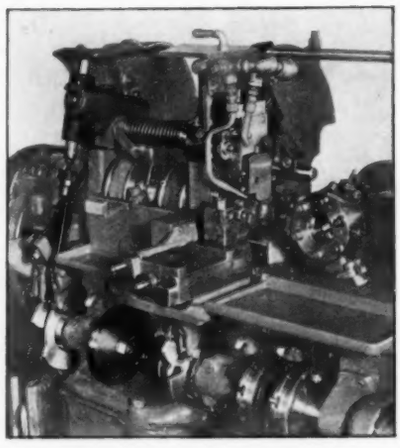
The Bristol Co., S. Main St., Waterbury, Conn., is offering the Rockwell-Bristol Dilatometer, Model RB, for indicating and recording time-dilation and temperature-dilation changes simultaneously during heating and cooling cycles of ferrous and non-ferrous metals, ceramics and other materials of rigid form. Designed and engineered by Stanley P. Rockwell, who developed the Rockwell hardness tester, this instrument can be used for determining critical temperatures of ferrous metals, coefficients of expansion of all solids, grain size of ferrous metals, thermal composition of steel, heating rates, and heat saturation, and other factors. The temperatures are recorded by a standard Bristol "Pyromaster" potentiometer, modified only to the extent that the instrument's 12-in. round chart is revolved by the length of change of the work being investigated and the time element is recorded by a separate pen through a Telechron clock. The vertical heating furnace of this dilatometer is of the split type. Heating chamber is 3 in. diameter and 8 in. long. The sample to be studied is supported on quartz tubing and platform and quartz tubing to the magnifying lever system. The furnace may be kept closed during the cooling operation, or opened for faster cooling, or the supported test sample may with the whole system quickly rotate 90 deg. over a



quenching tank, which in turn is quickly raised and immerses the specimen in either brine, water or oil. With the aid of a program controller, cams may be cut to raise or hold or cool the specimen to any time period.

Attachment Permits Longitudinal Turning

Brown & Sharpe Mfg. Co., Providence, R. I., has announced the development of a longitudinal turning attachment for use on high-speed Nos. 00 and 00G automatic screw, turret forming, cutting-off and screw threading machines. It is essentially a vertical slide attachment provided with longitudinal movement. In addition to performing any vertical slide operation, it also will do straight turning to 1 in. in length. For turning behind a shoulder, it is useful in that it eliminates the need of a swing tool. Turning is accomplished independently of other operations and with the spindle running in either direction. Vertical and longitudinal movements are actuated by cams on the camshaft of the machine. Each cam moves a bell crank, link and rack. Springs keep rollers on both bell cranks in contact with the cams.



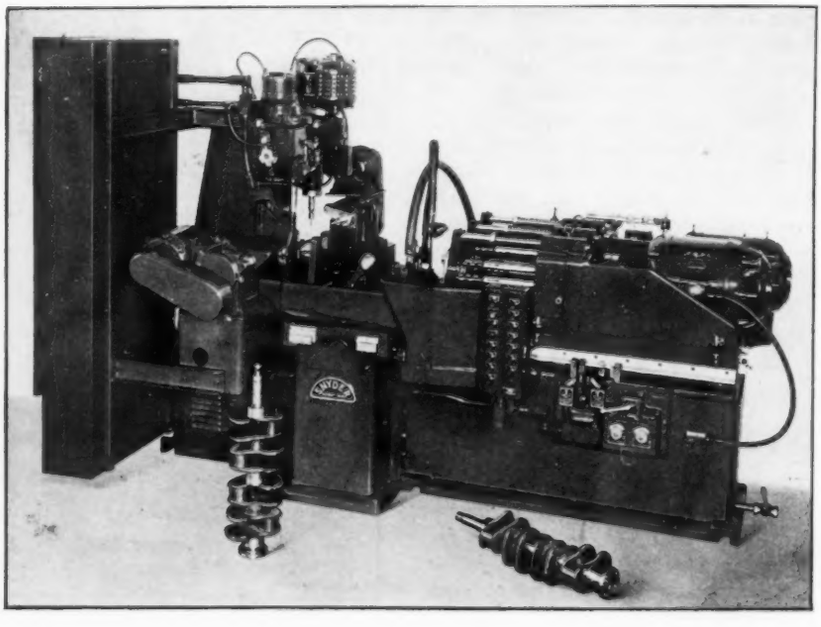
Snyder Station-Type Machine Drills, Reams and Taps Crankshafts

The slide-index station-type machine shown was built by the Snyder Tool & Engineering Co., 3400 E. Lafayette St., Detroit, Mich., for drilling chamfering, reaming and tapping tractor crankshafts. Production on this particular job is approximately 22 cranks per hour. Sufficient time is consumed on the multiple operations so that one operator can handle three or four similar machines, or do other work.

The table indexes hydraulically from the front to the rear on a slide, an hydraulic shot bolt locating the table at each station. When the last operation is completed, the table returns to the loading position. This cycle proceeds automatically after the operator presses a cycle pushbutton. A pushbutton station at the front, however, makes it possible to operate any head individually during set-up or tool changes.

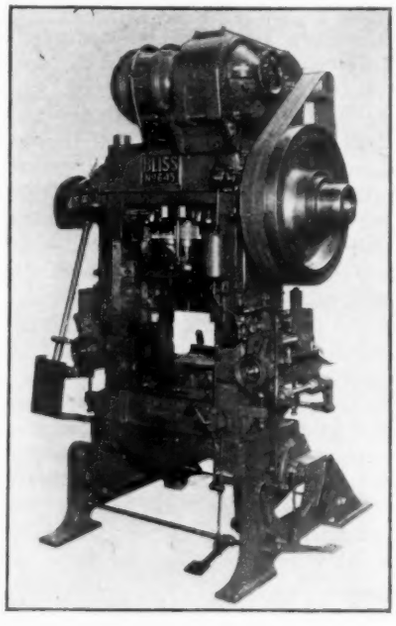
In this chankshaft set-up, the table index is toward the rear and past the drilling, chamfering, reaming and tapping heads located horizontally at the right end of the machine. These four heads operate on the flange. If another style crank is to be machined, the first three heads are removed as a unit and replaced with another unit in less than an hour's time. The tapping head is unbolted from its drive and likewise replaced quickly.

Heads at the left end of the machine perform additional drilling and tapping operations on the other end of the piece. One cross hole is drilled by the horizontal head at the front, and this hole is reamed by an opposed head at the rear. At an intermediate point in the cycle a vertical head drills and taps a setscrew hole at right angles to the cross hole.



Bliss High-Speed Press Runs in Three Positions

Inclined mountings for the Series 645 high-production presses, by which the machine can be operated in any one of three optional positions, have been made available by E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn, N. Y. Square pockets in the legs of the press support the machine.

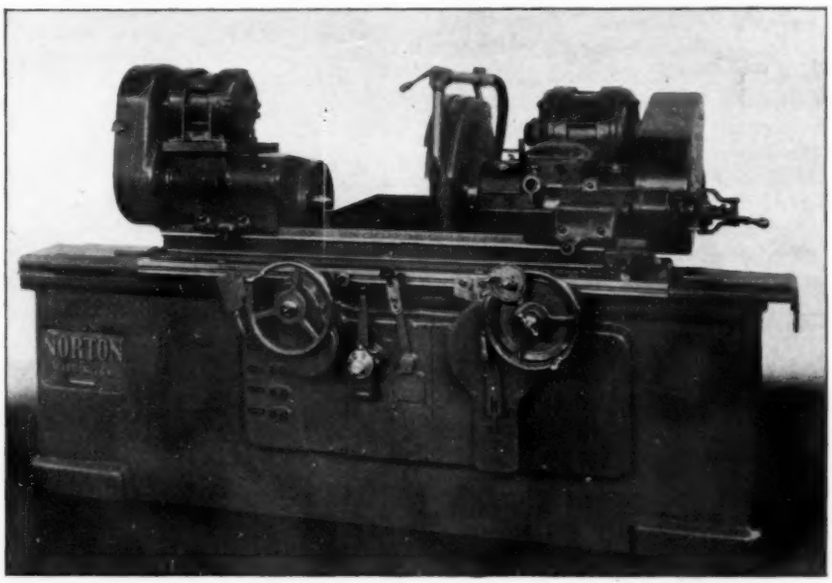


With this feature the press can be used for work which is blanked through the dies and bed while the press is in an upright position. It can also be used for work that is either ejected by the bar knockout or is returned to the surface and is discharged by gravity while the press is

inclined. Adjustable cam knockouts are also available.

The press is equipped with precision-lined gibs adjustable to 0.0005 in., bronze ball seats for the connections, and bronze-bushed main bearings with automatic force-feed lubrication. Features include a high-speed rolling key clutch, precision feed, and a bolster and clamping cap which is designed so that the dies can be set and tried out without returning the press to the vertical position. Operating speed of the No. 645 press is variable, ranging from 100 to 300 strokes per minute.

Norton 10-In. Type C Grinders Feature Several Design Improvements



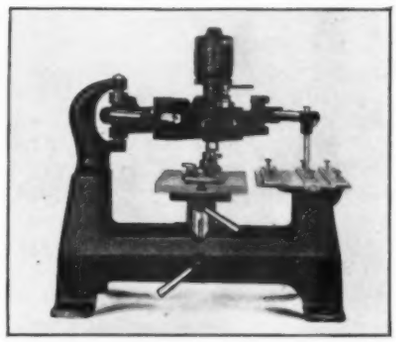
A number of refinements have been incorporated in the new line of 10-in. Type C cylindrical grinders manufactured by Norton Co., Worcester, Mass. Oil and coolant reservoirs have been made an integral part of the improved base, and a large cored receptacle is provided at the rear of the base for mounting motor-starting equipment. Oil and coolant pumps are suspended vertically on springs so that the pumps now run submerged.

Wheelslide and table ways are pressure lubricated from a separate system, thus permitting the use of oils of different viscosities for strictly lubricating purposes and as the hydraulic fluid for the operation of various units so controlled. V-belts and a silent chain running in oil drive the headstock. Both headstock and footstock have been redesigned, larger spindles and centers being used to provide rigid support to the work.

These Type C machines are made with hand, hydraulic or mechanical traverse of table. A semi-automatic model arranged for hand or hydraulic table traverse also is available. In addition, semi-automatic machines usually are equipped with hydraulically-operated footstock and headstock. An hydraulically-operated steadyrest also is available. The semi-automatic machines are of the plunge-cut type and parts are ground with the operator simply placing the work between centers and moving a single lever to initiate the grinding cycle. Semi-automatic machines also can be arranged for manual control. In this case, the operator places a dial gage on the work and from it observes when the correct size is obtained. These machines can be converted from manual to automatic control merely by turning a convenient switch.

Preis "Panto" Engraver Has Depth-of-Cut Control

Models UE and UM bench-type pantographic engravers and electric etchers introduced by H. P. Preis Engraving Machine Co., 157 Summit St., Newark, N. J., employ quickly interchangeable heads for the two classes of work. For engraving work, depth of cut is controlled independent of the depth of master characters by a



micrometer adjustment mechanism on the engraving head. Vertical movement of the cutter is controlled by a cam-action drop lever, thus eliminating the need for raising and lowering the pantograph. Either raised or sunk engraving can be produced. An automatic depth-of-cut regulator is furnished for engraving on concave or convex surfaces, or on objects varying in thickness. When set up for electric marking, contact of the etching point with the work is controlled by sensitive spring pressure. The etching point may be removed from its fixture and used as a hand-etching pencil for rough or freehand marking. An electrical transformer furnished with the etching head provides three or more voltage stages for various depths of marking. Work table measures 6 x 9 in. and is adjustable 5 in. longitudinally and 3 in. vertically.

Reed Bench Drill is Ball Bearing Equipped

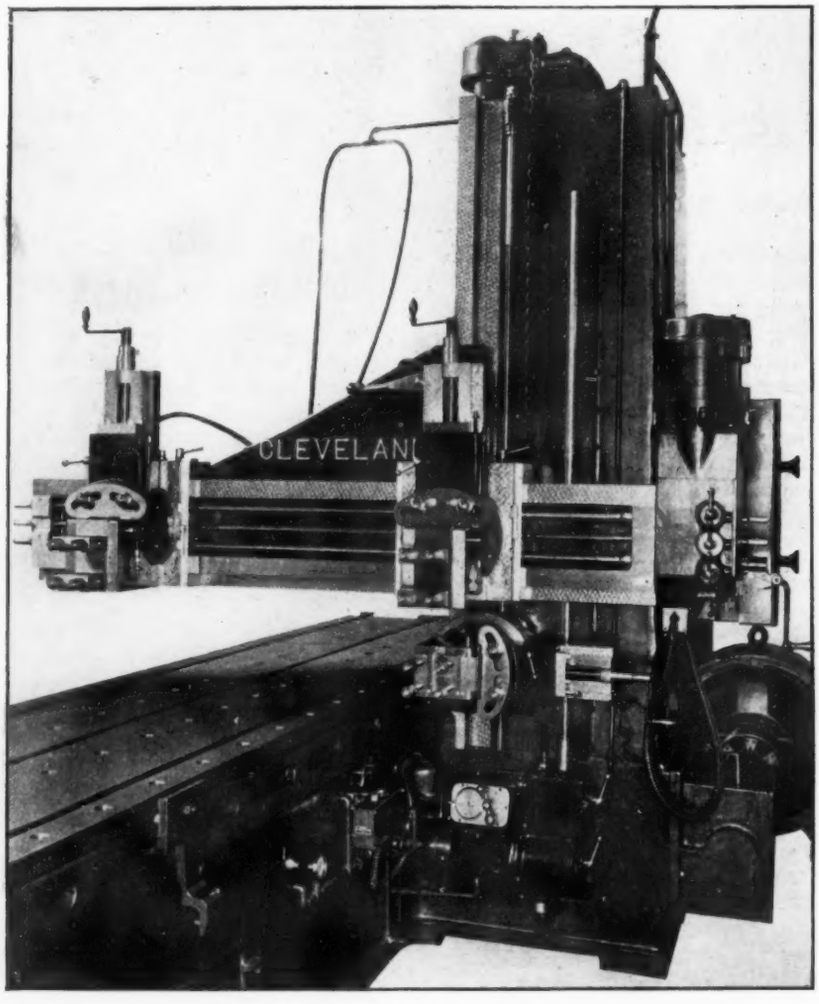
The Type R high-speed, full ball bearing bench-type drill offered by Francis Reed Co. Drill Div., Production Machine Co., Greenfield, Mass., has individual motor drive for each

spindle and is available in single- or multiple-spindle units. Ten speeds, ranging from 3,000 to 10,000 r.p.m., are available. This machine has $\frac{3}{16}$-in. capacity with 3-in. spindle travel and 3-in. adjustment of head. Distance from center of spindle to column is 7 in. For multiple units, center to center distance is 8 in. This machine can be foot operated.

Improved Cleveland Open-Side Planer Designed for Direct-Connected Drive

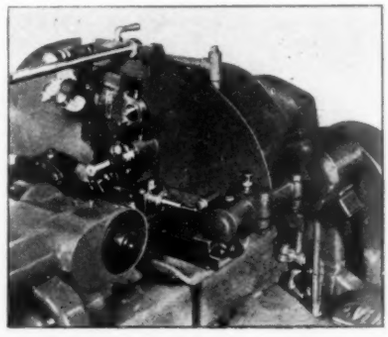
Table drive gearing of the improved open-side planers announced by Cleveland Planer Co., 3148 Superior Ave., Cleveland, Ohio, has been designed so that it will operate smoothly and efficiently under the various low and high speeds now obtainable through variable speed, reversing-type planer drive motors direct-connected to the gear box. Power rapid traverse on these planers also has been redesigned. It now is a direct-connected motor drive unit entirely independent of the feeds and other operating mechanism. Also, end pockets extend the full width of the bed.

These open-side planers are available in 26x26 in. to 72x72 in. sizes with tables from 6 to 16 ft. long. The side head will plane vertically for a distance of 26 in. on the 26x26 in. machine to 72 in. on the 72x72 in. machine. Railhead has a down feed of 10 in. and 21½ in. respectively for the two sizes mentioned. Beds, columns, tables and knees are of nickel chrome semi-steel castings. The table rack, the rail and all heads are made of Meehanite iron. All mechanism is above the floor level, the machine does not require a pit or special foundation. Dial feed ranges from 0 to 1 in. by 0.010 in. and is positive in action. All driving mechanism is readily accessible. The operator can reach all control levers from one position. Force feed lubrication is used.



Motor Drives Available For Drilling Attachments

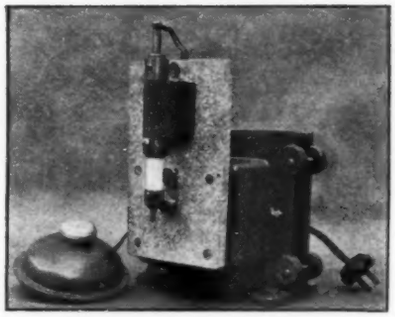
Motor drives for cross drilling and turret drilling attachments have been made available by Brown & Sharpe Mfg. Co., Providence, R. I., for use on Nos. 00G, 0G and 2G automatic screw and turret forming machines of the high-speed type. The motor is attached by a bracket to the rear of the machine bed and drives a pair of bevel gears in a case at the end of the bracket. The drive is transmitted from the gears to the drill spindle by another shaft assembly. This mechanism in no way limits the movement



of the cross slide or the position of the attachment spindle with relation to the cross slide. Drill speed for the cross drilling attachment is 4,950 r.p.m. for all sizes of machines. The motor drive for turret drilling attachments includes everything necessary to drive by motor drill spindle assemblies of the turret attachment. Like the cross drilling unit, drive is transmitted through bevel gears and the mechanism does not limit the indexing of the turret or the movement of the turret slide. Drill speeds are 4,550 r.p.m. for the No. 00G machine, 4,050 r.p.m. for the No. 0G machine and 4,360 r.p.m. for the No. 2G machine. Since the drill rotates opposite to the work, the cutting speed of the drill equals the drill speed plus the work speed. A combination unit available for the same machines permits motor drive of drill spindle assemblies of both the cross drilling and turret drilling attachments. This unit is essentially a combination of the two above drives.

Cole Soldering Tool Electrically Heated

The No. 2 "Instansolder" arc-heated soldering tool offered by Cole Radio Works, 86 Westville Ave., Caldwell, N. J., is a bench-type tool in which



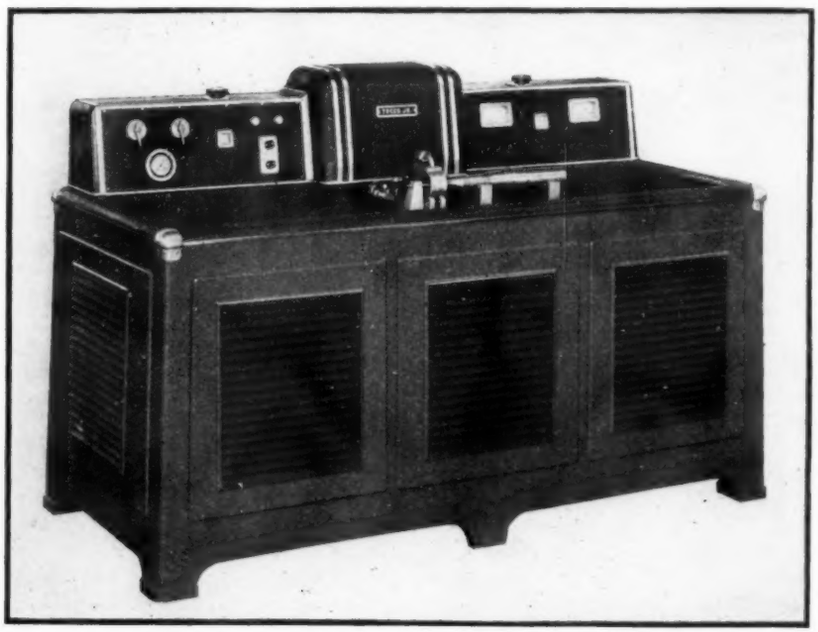
the conventional wire heating element is replaced by a small electric arc for heating the copper tip. A carbon electrode is fed automatically against the tip by spring pressure, so that the operator need make no adjustments. The head is mounted on the necessary transformer, and a foot switch connected with flexible cord to the unit controls the "off and on" operation of the iron and temperature of the soldering tip. No electric current is used until the operator steps on the swich. Then the iron heats up very rapidly. In a matter of 30 sec. it will melt "half and half" solder wire, and in a few seconds more is ready for soldering. To obtain higher soldering temperature, the operator simply keeps the foot switch closed for a longer time, and vice versa. The shape of the tip can be modified to meet any soldering requirement. The unit is designed for use on a.c. only, for circuits of 115 or 230 volts. It is 9 in. high, $7\frac{1}{8}$ in. wide and 7 in. deep. Net weight is 18 lb.

"Tocco Junior" Heat-Treating Unit Surface-Hardens Small Parts

The "Tocco Junior" surface-hardening machine developed by the Ohio Crankshaft Co., 6600 Clement Ave., Cleveland, Ohio, is a compact, automatically-controlled unit incorporating all features of the "Tocco" induction heat-treating process. Equipped with a specially designed, built-in, high-frequency current converter, this unit fits readily into the production line, with which it can be coordinated. It provides split-second accuracy for hardening parts by electrical induction.

The process employed is selective and the hardened surface is kept within close limits, both as to area and depth of penetration. It is not necessary to heat the whole piece and because of the short split-second heating time, there is no scaling. Hence straightening and cleaning operations are eliminated. Surface-hardened zone is said to blend into the core with no sharp line of demarkation.

Parts as widely varied as drill chuck bodies and ice skates have been hardened in this machine. It is available in four sizes of 8, 15, 22 and 30 kva. capacity respectively. Each of the four machines is housed in a cabinet 78 in. long, 36 in. deep and 36 in. high. All controls are within easy reach of the operator. Time cycles and power input are pre-set and the hardening cycle is automatically controlled. Once the set-up has been made, the placing of parts within the inductor coil is the only manual operation. Shifting from one part to another is readily accomplished in a few minutes by merely adjusting the control dials to a predetermined setting, and by changing to a suitable hardening fixture. Changing fixtures is effected by loosening two nuts on the high-frequency current leads and two hose connections on the water jackets. The fixture then can be removed quickly. Water and power connections are all that are necessary in order to install the "Tocco Junior" machine into a production line.

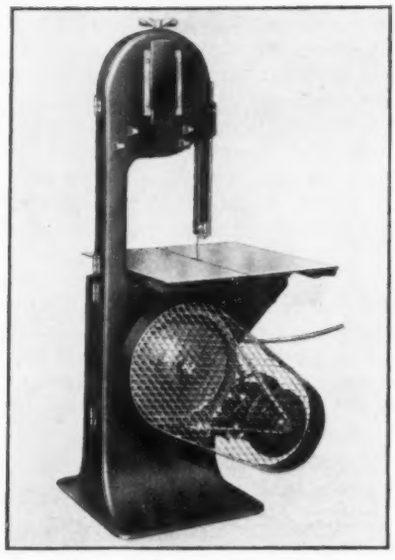


The "Tocco Junior" surface hardening machine employs electrical induction for heating and incorporates a water spray jacket in the fixture for quenching. Four sizes are available

Surface hardening fixtures are mounted on the cabinet table of the "Tocco Junior." Fixtures are interchanged easily

Wells Band Saw Cuts Metal and Wood

The No. 9 vertical metal and wood cutting band saw, placed on the market by Wells Mfg. Corp., 315 Seventh Ave., Three Rivers, Mich., provides speeds of 60, 90, 250 and 500 ft. per min. for up to $\frac{1}{2}$-in. blades. The 28x28-in. table is made of heavy metal plate bolted through steel bars to the base. Throat is $11\frac{3}{4}$ in. deep and work $15\frac{1}{2}$ in. high can be accommodated. Ball bearings are used throughout, these being of the grease-

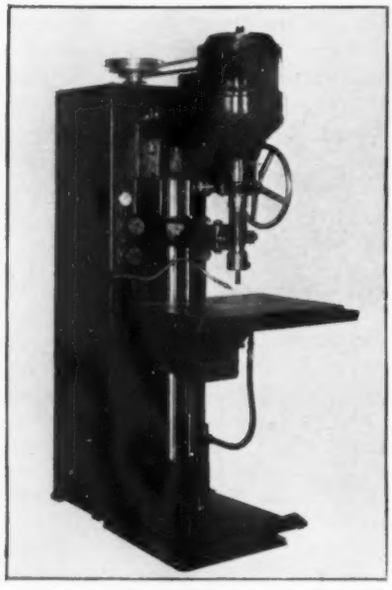


sealed type. The machine weighs 600 lb. and requires a 28x30-in. floor space. A $\frac{3}{8}$-hp. motor drives the saw blades through V-belt sheaves.

Bakewell Tappers Use Hardened Leadscrews

Nos. 1 and 2 vertical tappers, offered by Bakewell Mfg. Co., 2427 E. 14th St., Los Angeles, Calif., are arranged so that precision tapping operations are performed by leading the tap into the hole correctly and leading it out in the same path. The tap is held in a rigid rotating spindle to which is attached a precision hardened and ground combination leadscrew and hob. The latter is used for milling threads in two brass fingers attached to hinged arms, which are actuated by a solenoid through a toggle joint. When these fingers mesh with the leadscrew, the tap is led into the piece being threaded and receded without ironing out the thread during the reversing operation.

The No. 1 machine is capable of 20 reversals per min. and has two speeds, 900 and 1,800 r.p.m. It has capacity for 6/32 to $\frac{7}{16}$ in. taps in mild steel, or will tap $\frac{1}{8}$ to $\frac{1}{4}$ in. pipe threads in S.A.E. 4140 steel; also $\frac{3}{8}$-in. pipe threads in brass or aluminum alloys. The No. 2 tapping machine has a range of sixteen spindle speeds. Its capacity is $\frac{1}{2}$ in. U. S. standard threads to $1\frac{1}{4}$ in. pipe threads in steel, or will tap 2 in. pipe threads in softer metals such as aluminum alloys, brass and bronze. The No. 2 tapper is equipped with an hydraulic torque control.

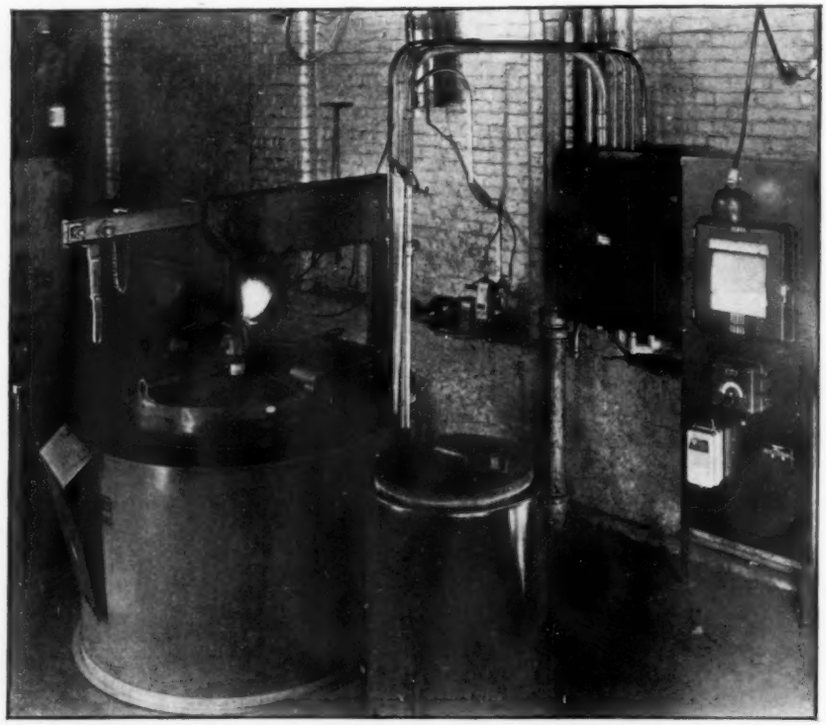


"Homocarb" Automatic Furnace Develops Uniform Case Rapidly

A carburized case of any specified depth within the carburizing range is secured uniformly and rapidly in the "Homocarb" automatically-controlled furnace developed by Leeds & Northrup Co., 4934 Stention Ave., Philadelphia, Pa. With this equipment, the heat-treater can follow carburizing specifications accurately, as there are separate and fully-automatic controls for temperature and for amount of carburizing medium. These controls permit the operator to vary any factor or factors while holding the rest constant, thus making possible marked improvement in successive batches of parts until conditions that give ideal case structure are determined. These conditions are then automatically secured in batch after batch.

There is no packing of work for "Homocarb" carburizing; parts are put into the furnace bare for exposure to the Homocarb gas. Large parts are loaded either in the furnace basket, or on fixtures. Small parts are simply dumped into the basket or into trays.

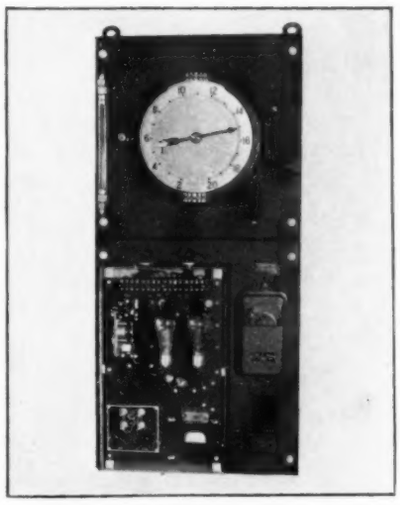
This equipment applies to the carburizing process the "Homo" method of short-path, forced convection. It takes "Homocarb" fluid, a specially-prepared hydrocarbon oil, and cracks it inside the furnace into a gas rich in carbon and uniform in chemical analysis. A high-pressure fan, located immediately below the work, swirls this gas at full carburizing temperature directly into every crevice of the load and to every surface of each piece. The carburized case develops at a rapid, predictable rate that is practically the same for parts of all sizes, regardless of the density with which they pack into the furnace.



"Reactrol" Regulates Heating Temperatures

A system which automatically regulates power input to electrically heated equipment, thereby controlling accurately the temperature differential, has been announced by General Electric Co., Schenectady, N. Y. Called the "Reactrol" system, it regulates power input by varying the voltage impressed on the heating resistors in accordance with temperature or pressure requirements. It is suitable for continuous processes and the treatment of materials employing furnaces, boilers, and air heaters.

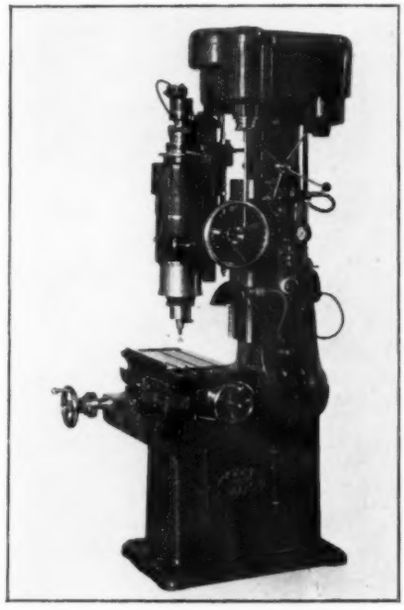
In its simplest form, the "Reactrol" system consists of a control panel, a temperature- or pressure-control instrument, and a saturable-core reactor. In operation, the pressure- or temperature - control instrument (which contains a special potentiometer) feeds low-voltage current into an amplifying tube on the control



panel. This tube, in turn, regulates the flow of direct current to the saturable-core reactor which, acting like a valve, regulates the voltage applied and the amount of power going to the electric heating equipment.

Moore Vertical Jig Grinder Uses Interchangeable Wheel Heads

A jig grinder, so called because of its similarity in principle to the jig borer, has been designed by the Moore Special Tool Co., Inc., Bridgeport, Conn., to correct the location of holes in hardened steel parts, jigs, master plates, and gage parts. The base and compound table of the jig grinder are the same as for the Moore jig borer, but table ways and slides are protected from emery dust by guards.



This grinder is being marketed by Marburg Bros., Inc., 90 West St., New York, N. Y.

The upper part of the machine consists of a column on which is mounted the spindle head, corresponding to the boring spindle of the jig borer. The top housing contains the motor and variable-speed drives for both speeds and feeds. Speed control covers a range from 50 to 150 r.p.m. and the feed control a range from 0.004 in. to 0.020 in. per spindle revolution. The main spindle is a large sleeve mounted on two preloaded precision ball bearings. Inside this sleeve is mounted the vertical slide pivoted to swing from the vertical position up to a maximum of $1\frac{1}{2}$ deg. either way. Tapered holes can be ground up to a travel length of $3\frac{5}{8}$ in. The lower end of this vertical slide carries a cross-slide upon which is mounted the grinding head. This slide permits manual adjustment of the head up to 1 in. while the spindle is stationary. The cross-slide itself can be adjusted up to the limit of 0.100 in. while the spindle is in motion. This latter adjustment is accomplished by turning a knurled dial graduated for 0.0001 in. movements of the cross-slide.

Three special grinding heads can be attached to the cross-slide, giving a total range of grinding wheel speeds from 15,000 to 80,000 r.p.m.; both air and electrical equipment are available. A positive stop with fine adjustment of grinding depth eliminates danger to the wheel when grinding holes with shoulders. Grinding range covers holes as small as 0.090 in. in diameter or even less up to 4 in. either straight or tapered. Specifications: Table movement, $9\frac{1}{8} \times 14\frac{1}{4}$ in.; distance from table to wheel, 0 to 8 in.; table surface, 10×16 in.; vertical slide travel, $3\frac{5}{8}$ in.

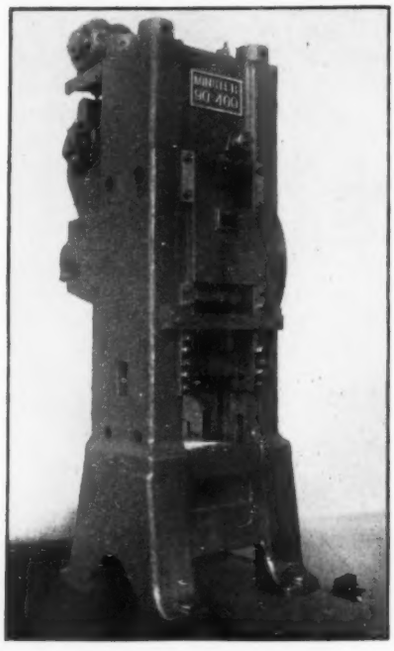
Ross Heavy-Duty Valve Uses Heavier Parts

A heavy-duty air control valve has been announced by Ross Operating Valve Co., 6489 Epworth Blvd., Detroit, Mich. Like other Ross valves,

this one is of the poppet type. The mounting flange, uprights, lever and other parts are much heavier than in standard valves. Alloy lever and rocker arm pins of increased diameter and fitted with needle-type roller bearings, larger stuffing boxes, stainless steel poppet stems and retainers, and other features give the valve extra strength and wear qualities. Mounting dimensions, pipe-connection locations and bolt holes in this valve remain the same as in standard Ross valves.

Series 90 Presses Made in Eight Sizes

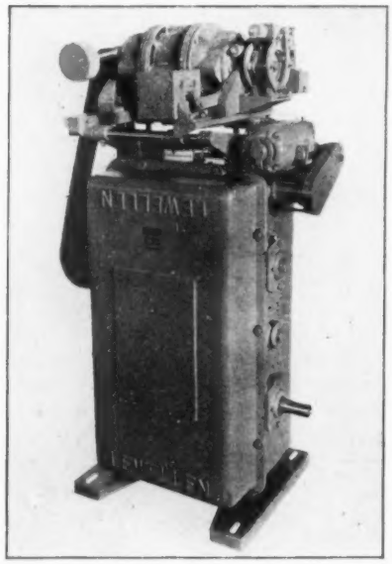
Improved Series 90 knuckle-joint embossing presses built by the Minster Machine Co., 52 W. Fifth St., Minster, Ohio, are of four-piece steel tie-rod construction. The eight sizes which comprise this series range in capacity from 150 to 1,500 tons. The 600-ton and larger presses have air-



operated combination multiple disk clutch and brake as standard equipment. This drive unit is optional equipment on smaller presses in lieu of the standard positive clutch. Each knuckle bearing is connected to a high-pressure continuous-circulating oil lubrication system and, in addition, a cascade of oil flows over the metal assembly. Dual oil filter promotes long bearing life.

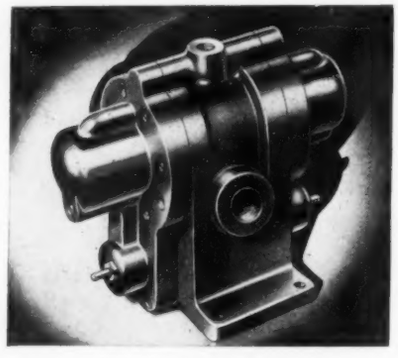
Lewellen Transmission Holds Uniform Tension

Developed especially to maintain uniform tension when winding strip metal, this variable speed transmission made by Lewellen Mfg. Co., 1050 E. Tenth St., Columbus, Ind., has full-automatic electric control. The winding reel starts at its highest speed, as the strip of material on the spool increases in diameter the control accurately reduces the speed of the reel to maintain uniform tension of the strip as it is wound. After the reel has filled and the unit is stopped for removing and replacing a new core, the control reverses its position to allow the new reel to start again at the maximum speed.



Racine Pressure Booster Self-Contained

The hydraulic pressure booster developed by the Racine Tool & Machine Co., 1439 Junction Ave., Racine, Wis., is a self-contained pumping unit that is hydraulically actuated to produce high pressure from a low-pressure pump. Its operation may be of variable or constant volume delivery, depending upon the actuating pump.



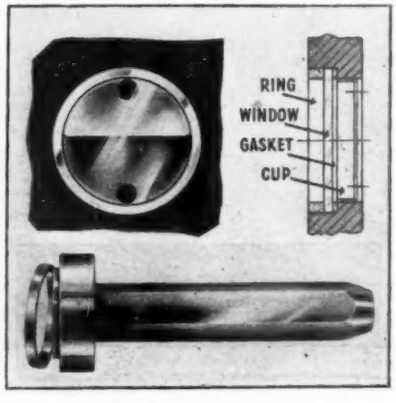
Its reciprocating piston-type action produces constant high pressures. These units are available in six sizes in ratios of 2:1 to 7:1 with high-pressure output capacities ranging from 3.4 to 6 gal. per min. These boosters are easily installed in existing hydraulic circuits. They are available for line pressures up to 3,000 lb. per sq. in.

"Pike-O-Scope" Magnifier Permits Close Inspection

The "Pike-O-Scope" (depth lens) illuminated magnifier offered by E. W. Pike & Co., Elizabeth, N. J., consists of a set of achromatic triple lenses, threaded in a Bakelite frame to permit proper focusing, and a special lamp in a molded cylinder which also serves as a handle. This electric unit with cord and plug can be substituted for a flashlight case illuminated by two dry cell batteries. Offered especially for the examination of the valve seat of gasoline engines, this magnifier can be used for close inspection of other parts. Defects can be seen at a distance of 2 ft. from the eye.

Bijur Oil Window Is Self-Contained

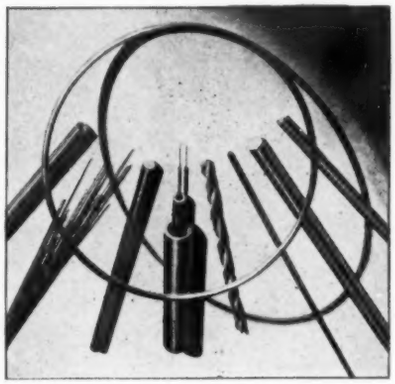
Bijur Lubricating Corp., Long Island City, N. Y., has developed a general-purpose sight oil window which is said to afford improved visibility. Offered for use in connection with oil reservoirs, containers and lubricators, this is a self-contained unit, which can be installed in a simple bored opening in the machine casting or part. The window assembly consists of a chromium-plated ring, window, gasket and cup, all fitted into a metal pocket. A drilled opening at the top



and at the bottom of the cup permits free passage of the oil. A bright aluminum background in the cup acts as a reflector which gives visibility to the oil level, even with imperfect lighting. Standard sizes have $\frac{3}{4}$-, $1\frac{1}{16}$- and $1\frac{5}{16}$-in. diameter reflectors.

Carboloy Announces Extruded Carbides

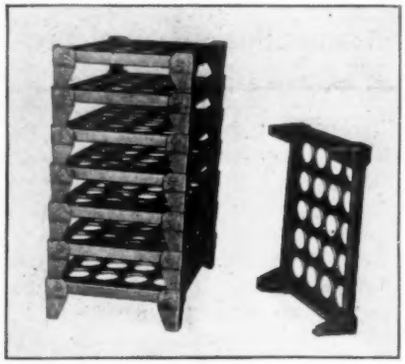
Carboloy cemented carbides now can be produced in the form of tubing, spirals and round or shaped bars by means of an extrusion process developed by Carboloy Co., Inc., 11149 E. Eight Mile Rd., Detroit, Mich. Available in lengths up to 20 in. and



within a diameter range of from 0.015 to $\frac{3}{8}$ in. outside diameter, these rods and tubes have use as wear resisting parts on machine tools and other products. The tubing can be as small as 0.060 in. outside diameter by 0.030 in. inside diameter, leaving a wall thickness of 0.015 in. By a supplementary process, these rods can be bent to various shapes. The 5 in. diameter ring illustrated was produced by this process. These two processes make available a range of shapes in sizes heretofore considered economically or mechanically impractical.

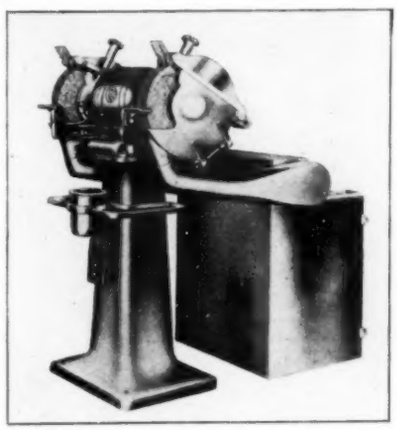
Stackbin Tote Trays Hold Finished Parts

A steel tote tray designed to hold finished or semi-finished machined parts without scratching or marring has been announced by Stackbin Corp., 42 Troy St., Providence, R. I. Of heavy steel construction, with all edges rounded to eliminate the possibility of scratching, these tote trays keep parts separated which might be marred by contact with each other. Finished parts can be taken from machines, stored in these trays and carried in them between operations. Because they are made entirely of steel, they can be used for dipping and draining parts. The trays are made to stack, eliminating the danger of their contents touching each other or of tipping over. Available with either pegs or holes, as needed, they can be furnished with removable wooden boards if desired.



Air-Master "Purifier" Made for Grinders

The "Air-Master" air purifier announced by the Cincinnati Electrical Tool Co., Div. R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, is constructed to fit floor-type grinders and buffers. It sucks dust and dirt from the grinding wheels, filters the



air through a series of filter bags, and returns the air to the room. Heavier particles fall immediately into a large tray in the bottom of the cabinet and a foot lever is provided for shaking the lighter particles from the filter bags into the tray, which is removable for cleaning.

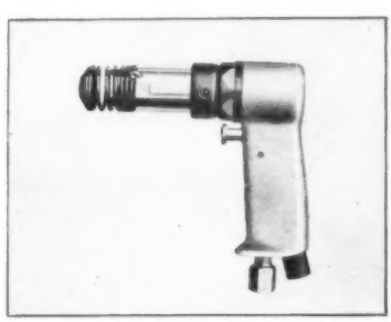
Milling Cutters Have Kennametal Blades

Developed in cooperation with the McCrosky Tool Corp., of Meadville, Pa., a series of milling cutters equipped with Kennametal-tipped blades has been announced by McKenna Metals Co., 103 Lloyd Ave., Latrobe, Pa. This series of cutters comprises nine standard sizes in each

of the following types of cutters: Medium-duty face mills, heavy-duty face mills, and shell end mills. Incorporated in these cutters is the "Jack-Lock" wedge developed by McCrosky to lock the blade into position. This wedge may be locked and unlocked without pounding. In addition, an adjusting screw in back of each blade permits fine and accurate forward adjustment so as to hold to a minimum the amount of carbide material that must be removed to align all blades when regrinding. Blades may be moved forward as little as 0.002 in.

"Cleco" Riveters Are Slow Hitting

Developed especially for use in the aircraft industry, slow-hitting and one-shot riveting hammers offered by the Cleveland Pneumatic Tool Co., 3734 East 78th St., Cleveland, Ohio, strike slow, accurately controlled blows at the proper speed and power to cause rivet metal to flow uniformly without crystallization. Their use is said to

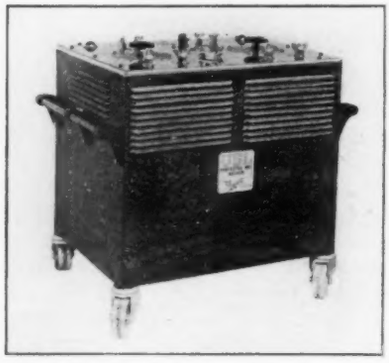


insure tight rivets, and to avoid damage to metal parts. These hammers are available in a variety of sizes, and with an assortment of handles suitable for practically all assembly conditions presented in airplane riveting

operations. Capacity ranges from $\frac{1}{16}$- to $\frac{3}{8}$-in. dural rivets for the various sizes. The No. E 2 riveter shown has capacity for $\frac{3}{32}$ to $\frac{1}{8}$ dural or soft iron rivets.

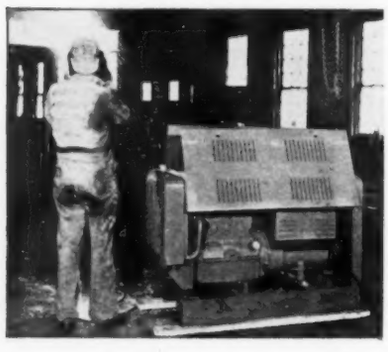
USL 500 Amp. Welder Used by Two Operators

The Owen-Dyneto Div., USL Battery Corp., Syracuse, N. Y., offers the Model 3W a.c. welder which can be operated at from 30 to 560 amp. and has a continuous 500-amp rating. Electrodes $\frac{1}{16}$- to $\frac{1}{2}$-in. diameter, inclusive, can be used with this machine, making it possible to weld a wide range of material thicknesses. The welder weighs 460 lb. and is designed to operate on either 220 or 440 volts. It can be used by two operators simultaneously at from 30 to 280 amp. each, by simply shifting a copper bar on the top of the welder.



Engine-Driven Welder Announced by Lincoln

The No. SAE-200 J engine-driven arc welder developed by The Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio, weighs less than 900 lb. Its characteristics makes it suitable for a wide range of d.c. arc welding. Current range of the single-operator, variable-voltage generator is 40 to 250 amp. for either bare, washed or heavily coated electrodes. Equipped with dual continuous control, this generator permits independent adjustment of both open-circuit voltage and welding current. Controls are self-indicating. The four-cylinder gasoline engine delivers 26 hp. at 1,800 r.p.m. Fuel tank capacity is 8 gal., enough for one day of operation.

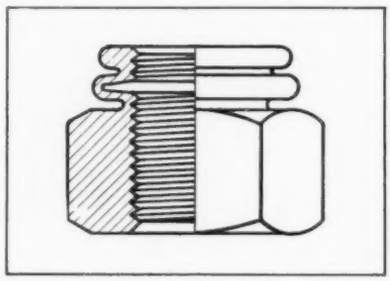


Boots Aircraft Nut Fits Ordinary Bolts

The one-piece all-metal self-locking "Aircraft" nut marketed by Boots Aircraft Nut Corp., Waterbury, Conn., is said to overcome vibration problems. It is on the approved list of the U. S. Army Air Corps for the construction of airplanes. It also is being used for critical adjustments on 1940 automobiles, railway and subway cars, and on other equipment where vibration is present.

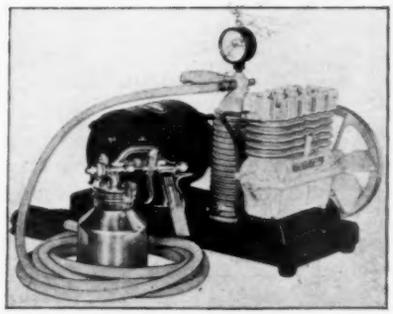
This aircraft nut fits ordinary bolts and can be used many times. Locking is accomplished by a spring member which exerts added axial force in the same direction as the tightening force. This prevents the nut from moving on the bolt until it is released intentionally.

Licensed manufacturers are: Scovill Mfg. Co., Waterbury, Conn.; United Car Fastener Co., Cambridge, Mass.; and New Britain Machine Co., New Britain, Conn. It is available in semi-finished hexagon types and in various special anchor types made from duralumin. Coarse and fine thread series are available.



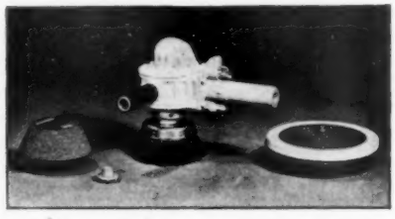
Empire Compressor Delivers Steady Flow

The "Pressure King" portable air compressor offered by Empire Compressor Mfg. Co., Inc., Benson St. and Pa. R. R., Reading (Cincinnati), Ohio, especially for paint spraying applications is said to deliver an even flow of air. Powered with a $\frac{1}{3}$-hp. motor, this four-cylinder compressor delivers 4 cu. ft. of air per minute at 60 lb. per sq. in. pressure. Pressure is adjustable from 0 to 80 lb. Air cleaning chambers filter the air and remove water, oil and other impurities. Stainless steel valves are easily removable. Intakes are protected with filters. This compressor also can be furnished powered with a $\frac{1}{2}$-hp. gasoline engine.



Rotor Vertical Grinders Use Multiport Governor

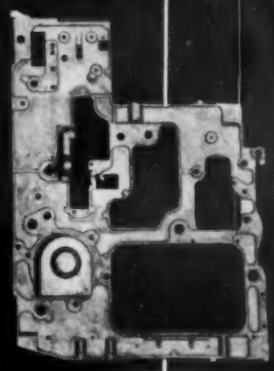
Types B-1X and B-3X vertical air grinders offered by the Rotor Tool Co., 17325 Euclid Ave., Cleveland, Ohio, operate at high speed under load. Maximum power is developed with less than ten per cent drop in the free speed, which gives high load speed for fast cutting action of the grinding wheel or sanding disk. The improved type M-8001 governor used in these tools is a balanced multiport unit which controls the maximum speed within the limits of the Safety Code. Both tools are used for grinding with 6x4x$\frac{5}{8}$-in. cup wheels, with a 9-in. flexible pad for disk sanding, or with 6-in. cup brushes for wire brushing. The smaller unit weighs 10 lb., while the Model B-3X grinder shown weighs 12$\frac{1}{2}$ lb.



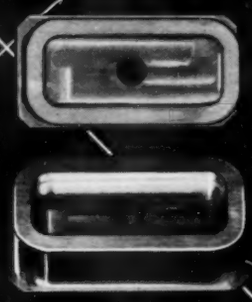
Comet Portable Welders Have 16-hp. Engine

Comet Products Co., Chappaqua, N. Y., has developed a portable heavy-duty d.c. electric arc welder which is driven by a two-cycle, two-cylinder engine rated at 16 hp. Offered in two sizes, rated at 125 and 175 amp., these d.c. welders can be used for practically all metals and alloys with bare or shielded-arc type

FROM *Blue-Print* INTO *Steel* IN A SINGLE SET-UP



DIE CAST TIME CLOCK FRAME
Note numerous radii and great amount of detail work —produced with speed and accuracy on the Model D.



FORMING DIE
Milled from solid to tolerances of .0005 in 4¼ hours. Can be group milled in lots of 6 at the rate of 2½ hours per piece.

DISTRIBUTOR COUNTER WEIGHT
All four cavities completed in a total time of 72 hours — previous time, ordinary equipment, 156 hours.

EXAMPLES OF ROTARY HEAD TOOL AND DIE MILLING MACHINE PERFORMANCE . . .

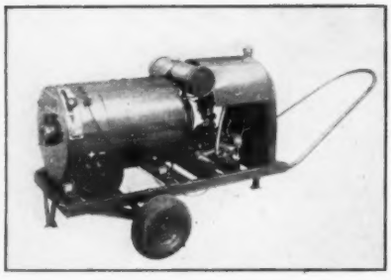
HERE are a few of hundreds of examples of the Rotary Head Method of tool and die making with a Milwaukee Model D — the machine that transmits blueprint into steel in a single set-up — layout, milling, drilling, precision boring and slotting operations!

Investigate this machine and the new technique it offers for the production of dies and tools—in far less time, with positive accuracy, and at costs much lower than ever thought possible.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN, U.S.A.

K&T

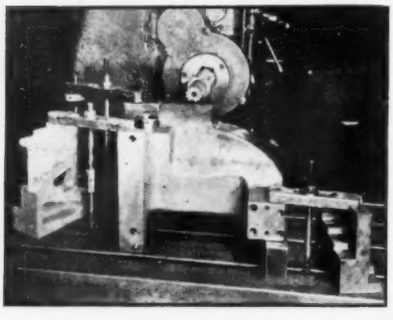
Milwaukee
MODEL D-ROTARY HEAD TOOL AND DIE MILLING MACHINE



electrodes, and for welding thin gage materials with the carbon arc method. A self-indicating current control enables the operator to select the type and intensity of arc to suit the job. Cable terminals permit easy change of welding polarity by switching electrode and current cable connections.

Set-Up Tools Simplify Clamping of Work

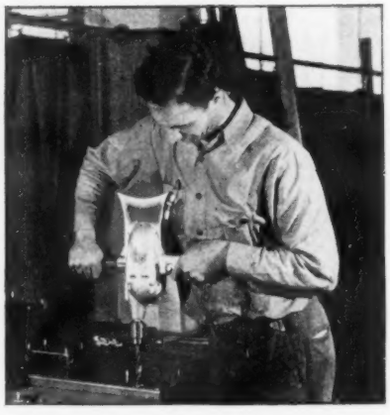
Standard step blocks, T-slot nuts and bolts, work-holding clamps, and adjustable clamp screw jacks offered by the Producto Machine Co., Bridgeport, Conn., simplify the setting up



and clamping of work on milling machines, boring mills, planers, and other machine tools. These units are available in various sizes for different types of work and can be grouped together as needed for particular jobs.

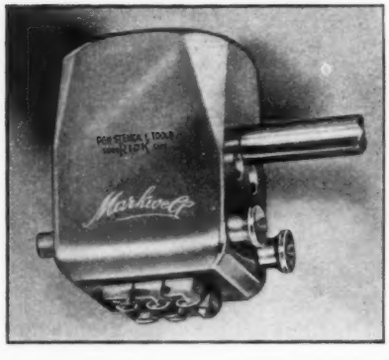
New Goodrich Paint Prevents Corrosion

No. 495 "Korolac" paint, added to the "Koroseal" series by the B. F. Goodrich Co., Akron, Ohio, is a solution of plasticized poly-vinyl chloride which gives a semi-glossy black finish and is recommended wherever extremely corrosive conditions are encountered. Applied to metal surfaces after they are prepared as for any other kind of paint or lacquer, the "Korolac" primer used with this paint forms a strong bond between the "Korolac" and the metal. When thoroughly dry, Korolac No. 495 will withstand all acids, alkalies and salts in the concentrations commonly encountered in industry, up to temperatures of 150 deg. F. It is not affected by chrome, nickel, cadmium, zinc, copper, brass, silver or tin plating solutions nor are such solutions contaminated by the paint when it is thoroughly dried. Both the primer and the paint can be applied by brushing or spraying.



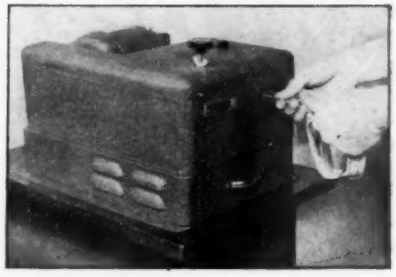
"Thor" Portable Drill Has $\frac{1}{2}$-in. Capacity

The Thor $\frac{1}{2}$-in. "Champion" light-duty portable electric drill announced by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill., is designed for intermittent service and can be used for drilling in both wood and metal. It weighs only $9\frac{1}{4}$ lb. and is $15\frac{1}{4}$ in. long.



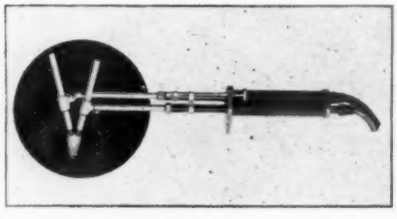
Rick Stamp Holder Marks Hot Metals

The Pittsburgh Stencil and Tool Co., 704 Crafts Bldg., Pittsburgh, Pa., has developed a tandem Rick "Markwell" stamp holder particularly for marking hot metals. This double line axe-type holder, with three pieces of type in each line, is made in sizes to take from $\frac{1}{16}$- to 1-in. type or larger. The only moving part is a pin, in each row of type, which carries its own spring. One quick motion locks it.



Ideal Wire Stripper Has Vacuum Collector

A vacuum attachment which draws the insulation materials into a drawer in the base of the unit is featured in the Model 9-C brush-type wire stripper offered by Ideal Commutator Dresser Co., 1057 Park Ave., Sycamore, Ill. This stripper will remove cotton and enamel, silk and enamel, string asbestos and other light insulations from round, flat or rectangular solid or stranded wire. It will remove gummy insulation imbedded in stranded wires and will clean both fine "Litz" and the new "Formex" magnet wire. Steel wire brushes are driven by a $\frac{1}{4}$-hp. motor.



Marquette Arc Torch Has Many Uses

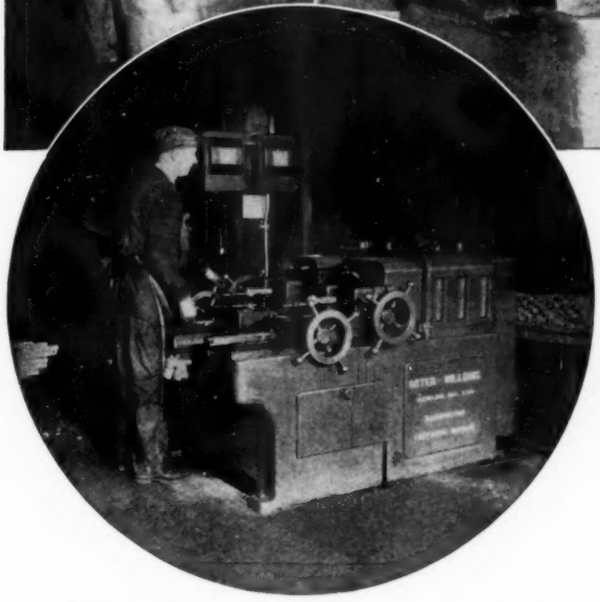
The arc torch announced by the Marquette Mfg. Co., Minneapolis, Minn., provides an independent source of heat, such as is supplied by a gas torch, for users of a.c. arc welding machines. With this torch it is possible to do general heating jobs, preheat, as well as weld aluminum, bronze, copper, nickel, silver and other non-ferrous metals. Brazing and soldering can be done, and hard surfacing paste can be applied. Two sets each of $\frac{3}{8}$- and $\frac{1}{4}$-in. arc torch carbons are furnished with the torch.

Joints Offered For Electro-Chemical Lines

A complete assortment of insulating joints for electro-chemical pipe lines has been developed by the Hanson-Van Winkle-Munning Co., Matawan, N. J. These joints are made of malleable iron and include compressed fiber insulating rings which encircle

MAKING GOOD WHEREVER INSTALLED

Salvaging rusted bolts in large midwestern railway shop



● NEWEST machine in its class, the Rapiduction has already forced its way to the front. Fast, accurate and easy to set up for standard or special jobs, it will handle bolts, staybolts, anchor bolts, tie rods, jackscrews, vise screws, steering rod knuckles, heavy cap screws, hooks and eyes, pipe, nipples or what have you. Capacity, ½" to 2¼", or ⅜" to 1½", in both single spindle and double spindle types. Spindle speeds, 32 to 298 R. P. M.

● The first purchasers of Rapiduction Bolt Threaders bought on recognition of sound engineering and faith in the OSTER-WILLIAMS reputation. Today the orders are based on demonstrated superiority of performance. Before buying any production bolt threader get the RAPIDUCTION facts. Write

THE OSTER MANUFACTURING COMPANY

Sales Office: 2049 East 61st Street, Cleveland, Ohio

Factories: Erie, Penna., and Cleveland, Ohio

New York City Office: 30 Church St.

Philadelphia Showroom and Office: 111 North 3rd Street

THREADING HEADQUARTERS SINCE 1893

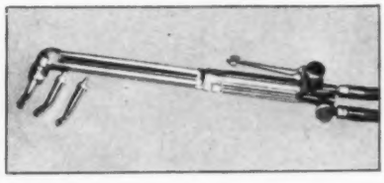
OSTER THREADING EQUIPMENT WILLIAMS

RAPIDUCTION BOLT THREADER

the ball member at two different places. They are tested for 125 volts d.c. service and 200 lb. per sq. in. steam pressure. They may be used safely under hydraulic pressures as high as 1,000 lb. per sq. in., depending upon the size of the joint. Their flexibility is another advantage, as it prevents pipe breakage due to expansion, contraction or vibration strains. They are recommended for cleaning tanks, plating tanks and heating and cooling lines.

Oxweld Gouging Nozzles Fit Standard Blowpipes

A series of "Oxweld" oxy-acetylene gouging nozzles is offered by the Linde Air Products Co., 30 E. 42nd St., New York, N. Y., for use with standard hand-cutting medium-pressure blowpipes, such as the "Oxweld" No. C-32 blowpipe. These nozzles, which are available in 3 sizes, provide means for quickly and accurately removing a narrow strip of surface metal from steel plates, forgings and castings. The nozzles are designed so as to deliver a relatively large jet of oxygen at low velocity. By proper manipulation, a smooth, accurately-defined groove can be cut or gouged out of the surface of the metal.



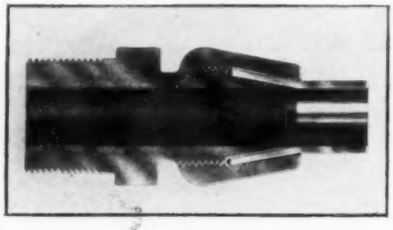
Tone Value and Adhesion Feature Plastic Finishes

The Sherwin-Williams Company, 101 Prospect Ave. N. W., Cleveland, Ohio, announces the development of "Kem Plactite" enamel, formulated for finishing plastic materials and designed to provide thorough adhesion to the hard surface of plastics. It is reported that tests on plastic formulations indicate this finish withstands severe abrasion and impact without marring or chipping.

Another finish known as "Kem Bakolescent" enamel containing opalescent particles also is being marketed. It gives beauty, richness and depth of tone to plastics and is said to have good adhesion. A slight variation in the finish formulation sometimes may be recommended for best results in finishing certain molding compounds.

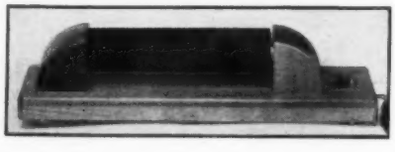
Tight Joints Made With "Superseal" Units

The "Superseal" connector is designed for use with aluminum, brass, copper and steel tubing from $\frac{1}{8}$ to 2 in. diamteers. The coupling has a compression joint sealed both inside and outside the ends of tubing flared to a 20-deg. angle, the long flare being used to obtain a tight seal by wedging the tubing between the self-aligning compression nut and the fitting. The sealed flare can be loosened and tightened any number of times without injury to the tubing. When applied it leaves the full inside diameter of both tubing and fittings. These connectors are made by the Superseal Corp., 300 Fourth Ave., New York, N. Y.



Vandenwood Desk Unit Makes 10×18-in. Prints

The Vandenwood Co., 2900 Euclid Ave., Cleveland, Ohio, has announced a small "Baby Blue" desk-type blueprint machine which will make black and white, as well as blue, prints. Printing capacity is 10 x 18 in. Source of light is a tubular lamp which is said to insure even distribution of light. The unit is 34 in. long and 8 in. wide, and weighs 15 lb. It is equipped with a time switch, so that the operator can perform other tasks while a print is being exposed. The lamp requires 20-watts. Unit is portable and may be plugged into any lighting circuit.

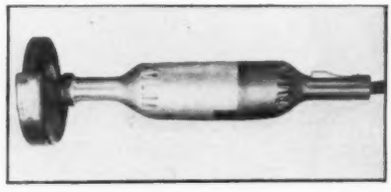


Zenith Transfer Switch Protects Light Circuits

The Zenith Electric Co., 845 S. Wabash Ave., Chicago, Ill., has developed an automatic transfer switch of the spring gravity drop-out type for automatically connecting a lighting or power load to an emergency source in case of failure. The unit is available in one-, two-, three-, or four-pole construction in capacities of from 30 to 300 amp. The switch will transfer when the voltage of the circuit drops to 70% or less, and will restore the load to the normal source when the voltage reaches 90% of normal. Contacts are copper to copper and operate with a rolling and wiping action.

Sawyer Grinders Have Few Parts

Portable grinders featuring moderate rotor speeds and electrical construction which eliminates commutator brushes and centrifugal switches are being manufactured by the Sawyer Electrical Mfg. Co., Los Angeles, Calif. The two-pole polyphase motor is totally inclosed, and the rotor is an integral part of a shaft mounted on anti-friction bearings; it is the only rotating part. The grinders are available in 1-, $1\frac{1}{2}$-, and 2-hp. portable sizes and in a $2\frac{1}{2}$-hp. suspended aerial type.



H. T. M. Alloy Steel Machinable at 450 Brinell

H. T. M. alloy steel offered by Joseph T. Ryerson & Son, Inc., 16th & Rockwell Sts., Chicago, Ill., is claimed to have the characteristic of being machinable under ordinary shop conditions after being hardened to more than 450 Brinell. This steel is a chrome-nickel-molybdenum alloy in which the alloying elements are so balanced that it will develop a high degree of hardness in either oil quench or air cooling. It was developed for applications where a very high tensile, high hardness and deep hardening alloy is desired and where in large sections uniformity of hardness from the surface to the center is desirable. With a suitable type of heat-treatment, sizes as large as 10-in. rounds can be made to show uniform hardness throughout the entire cross section. The alloy is said to be particularly resistant to impact and shock at

sub-zero temperatures. It also is suitable for bolts used at high temperatures. For those who do not care to do their own heat-treating, this alloy is carried in stock under the name of Nikrome "M" which has the following typical minimum physical properties: tensile strength, 110,000 lb. per sq. in.; yield point, 90,000 lb. per sq. in.; elongation, 16 per cent in 2 in.; reduction of area, 47 per cent; Brinell hardness, 240-265.

"Bifurcator" Unit Removes Hazardous Fumes

The "Bifurcator" ventilating unit offered by DeBothezat Ventilating Equipment Div., American Machine & Metals, Inc., East Moline, Ill., is designed to remove corrosive, toxic, high-temperature and other hazardous fumes. The unit consists of an axial-flow pressure fan mounted in a housing with the motor set in a separate built-in chamber, entirely insulated from the air flow. Thus the motor remains cool and is completely protected from fumes and gases, which are bypassed around it. These ventilators are available in sizes from 8 to 48 in. in a wide range of metals and alloys.

Cassette Minimizes Work In X-Ray Inspection

The St. John X-Ray Service, Inc., 30-20 Thomson Ave., Long Island City, N. Y., offers an "Economy Cassette" which always remains with the radiograph inspection equipment. Only a flexible film holder need be carried to and from the dark room for loading the film, thereby eliminating the use of heavy and expensive metal units. The cassette enables the X-ray technician to have a larger supply of folders available, thus speeding up his work. Another feature of this device is the interchangeable filter front, which can be changed in accordance with the voltage employed and the thickness of the metal to be penetrated. Previously, filters were incorporated in the individual folders.

Oxide Treatment Protects Fafnir Bearing Parts

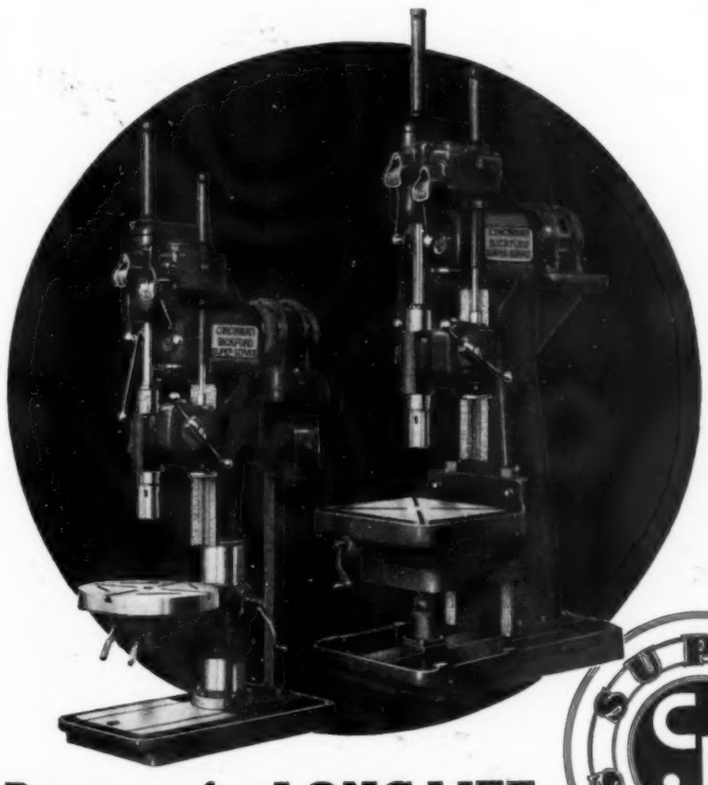
The Fafnir Bearing Co., New Britain, Conn., has announced development of a process whereby exposed parts of ball bearing transmission units are chemically treated to resist corrosion. The process involves the formation of an oxide layer which penetrates 0.0002 to 0.0003 in. into the surface of the metal without changing its external dimensions. This protective layer, really a part of the metal itself, does not chip or peel and is not affected by temperature. The treatment is recognizable by a jet-black finish imparted to the metal.

Adjustable Sweatband Uses Synthetic Sponge

Made of synthetic sponge, a sweatband offered by American Optical Co., Southbridge, Mass., can be used over and over again after washing. Dimensions are 6¾x1¾ in. Equipped with elastic headband and buckle, the sweatband can be adjusted to fit any size head.

Fafnir Ball Bearings Have Porous Retainers

Ball bearings incorporating retainers made of oil-impregnated bronze have been developed by the Fafnir Bearing Co., New Britain, Conn. This retainer is said to be ideal for applications that are inaccessible, or subject



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Reasons for LONG LIFE and FAST OPERATION of SUPER-SERVICE UPRIGHTS 21", 24" and 28" Sizes.

Longer life from—direct connected driving motor . . . positive type feed clutch . . . automatic oiling . . . ball and roller bearing construction . . . use of heat treated alloy steel gearing . . . multiple splined shafts with integral keys and . . . complete enclosure of all mechanism.

Faster operation from—table arm controls at front of machine . . . automatic depth gauge . . . radial drill type of spindle control and feed engagement . . . direct reading speed and feed plates and . . . convenient levers for instant engagement of feed and speed.

Bulletin U-22 describes these modern all-geared drills. It's yours for the asking.

THE CINCINNATI BICKFORD TOOL CO.
OAKLEY CINCINNATI OHIO U.S.A.

to sub-zero temperatures, as it holds and slowly feeds sufficient oil to lubricate the ball bearing throughout its entire life. The retainer is fabricated from a die-pressed bronze, its porous structure forming a reservoir for the retention of as much as 25 per cent of its volume of oil.

Baked Finishes Removed With "Metastrip"

Designed to strip baked enamels, varnishes, lacquers, paints, Japan, and synthetic finishes from metals, "Metastrip" liquid offered by Estox Products Co., 155-1 Brewery St., New Haven, Conn., contains no caustics, but depends on emulsifying agents for its action. It floats the finished surface away from the metal quickly. The "Metastrip" bath is maintained at about 190-200 F. and the work is immersed. When the surface has been removed, the work is taken out and rinsed in hot water. No special equipment is required. "Metastrip" has a boiling point of 212 F. and is noninflammable. It is claimed not to injure the hands.

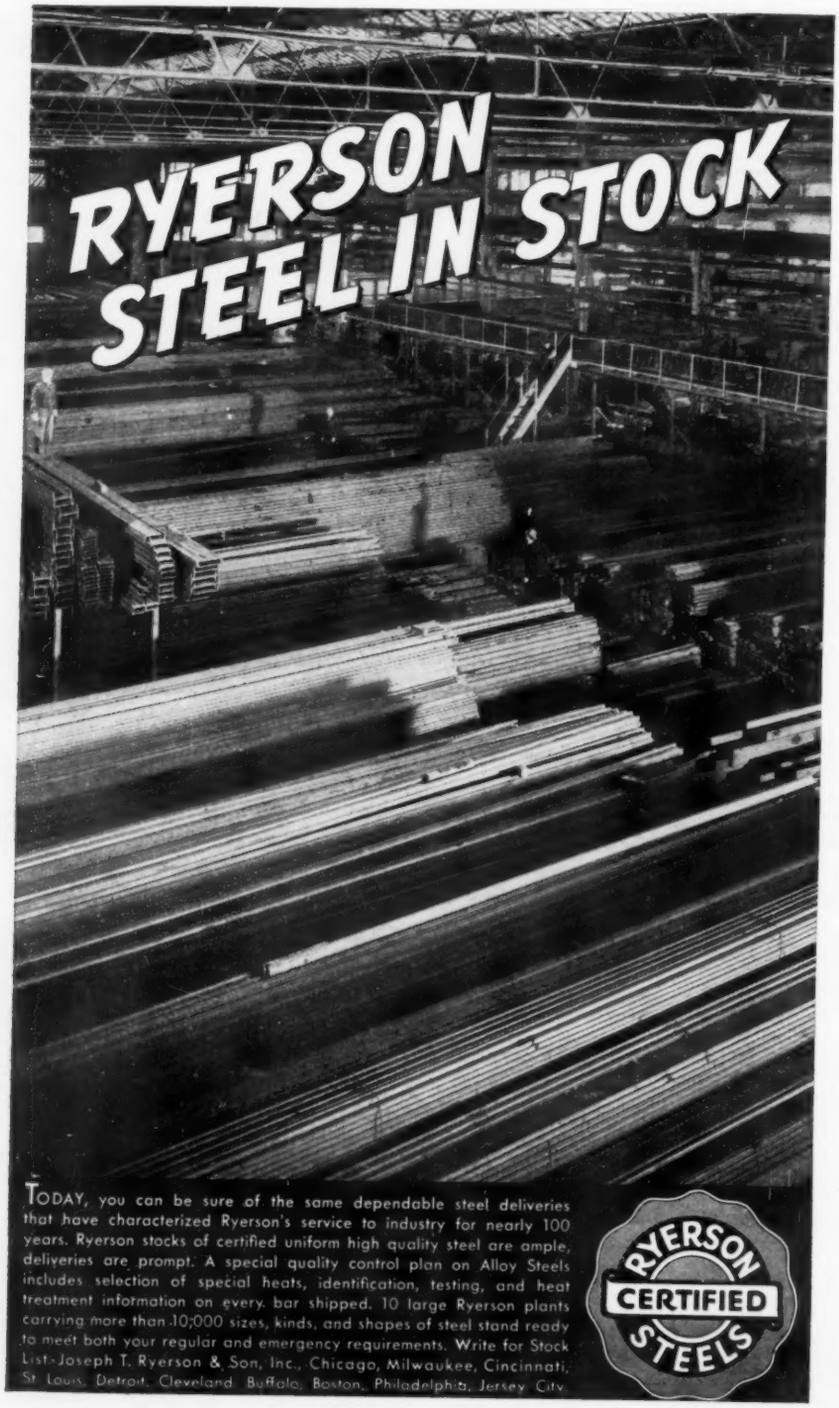
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Photo-Electric Units Replace Limit Switches

The "electric eye" limit switches offered by Photoswitch, Inc., 21 Chestnut St., Cambridge, Mass., are designed for use in heavy industries. These units are of rugged construction, suitable for installation where exacting conditions of vibration, humidity and high temperatures are encountered. Type A-14-B limit switch is supplied with the light source in weatherproof housings, suitable for installation in any location. Type A-20-C limit switch operately directly from the light given off by red hot metal of any shape. It provides limiting control, operates reversing rollers and conveyors, or counts the objects which pass before it.

Pushbutton Station Easily Installed

A three-button control station designed for easy installation and long life has been placed on the market by the Allen-Bradley Co., 1311 S. First St., Milwaukee, Wis. Button mechanism is of unit-type construction and is mounted in a die-cast box which is open at the front and both sides. A heavy molded plastic cover completes the inclosure.

Square D Breaker Has Indicating Handle

The Type M2 "Multi-BreakeR" offered by the Square D Co., Detroit, Mich., is of the two-pole, 100-amp. frame type and is trip-free. It cannot be held closed on a short circuit or overload. The indicating handle shows clearly whether the breaker is on, off or tripped. These breakers are tamper proof, factory calibrated and sealed, so that the proper capacity cannot be exceeded. They are available for flush or surface mounting. Capacities are 50, 70, 90 or 100 amp.

TRADE PUBLICATIONS

BEARINGS Johnson Bronze Co., 515 S. Mill St., New Castle, Pa., is distributing a handy "size finder" for more than 800 stock sizes of general-purpose bearings, including self-lubricating types and standard replacement motor bearings. This finder is in the form of a convenient slide rule which indicates inside diameter,

outside diameter, length, and part number of each bearing.

BOLTS An extensive line of bolts, nuts, screws and rivets is illustrated in the 90-page Catalog and Reference Book No. 39, published by the Clark Bros. Bolt Co., Milldale, Conn.

BROACHING Type XD double-slide vertical-surface broaching machines are described in a 12-page illustrated bulletin No. 924000, issued by the Oilgear Co., 1323 W. Bruce St., Milwaukee, Wis.

DIES A line of patented perforating and notching dies and accessories is described in the 56 pages of Catalog No. 5, published by the Strippit Corp., 1559 Niagara St., Buffalo, N. Y.

MAGNET WIRE Bulletin No. GEA-2973, published by the General Electric Co., Schenectady, N. Y., provides specifications of "Formex" magnet wire.

MAINTENANCE "Over the Rough Spots," an illustrated booklet discussing plant maintenance problems, has been issued by the Stonhard Co., 401 N. Broad St., Philadelphia, Pa.

MOTORS Slip ring motors of 1–350 hp. are described in Form No. 1032, issued by Century Electric Co., 1806 Pine St., St. Louis, Mo.

SAFETY American Optical Co., Southbridge, Mass., has made available a comprehensive industrial safety equipment catalog.

STATE TRADE WALLS The effect of laws restricting trade between the states are discussed in a pamphlet entitled "State Trade Walls" by F. Eugene Melder, assistant professor of economics at Clark University, and published by Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York, N. Y. Price, 10 cents.

STAINLESS STEEL Characteristics and uses of stainless steel castings are discussed in a booklet issued by the Atlas Stainless Steel Castings Division of Atlas Foundry Co., Irvington, N. J.

STEEL Section 5 of a general data book published by Joseph T. Ryerson & Son, Inc., Chicago, Ill., contains 144 pages of general data useful to the steel user.

THREAD MILLING Hanson-Whitney Machine Co., Hartford, Conn., has published a sixteen-page illustrated bulletin describing features and listing specifications of a 10x24-in. universal semi-automatic thread milling machine.

TRANSFORMERS A new line of instrument transformers is described in a 12-page booklet, No. B-2213, released by Dept. 7-N-20, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

TOOL HOLDERS Armstrong Bros. Tool Co., 315 N. Francisco Ave., Chicago, Ill., describes an extensive line of tool holders, C-Clamps and other machine shop accessories in Catalog No. C-39.

VALVES Specifications of a line of 200-lb. brass gate valves for steam, water, oil and gas lines are provided in a four-page folder, No. 311, issued by Crane Co., 836 S. Michigan Ave., Chicago, Ill.

WELDERS New 150-amp. d.c. arc welders are described in an illustrated Leaflet, No. GEA-3081B, issued by the General Electric Co., Schenectady, N. Y.

MORE PRECISION WORK
On Rivett 104
With interchangeable spindles for internal and external grinding you are always ready for MORE PRECISION WORK whether it be in the toolroom or on small lot production. The ease of set-up, wide range of adjustment and high spindle speeds have built the fame of "104" as a "work-getter" throughout this country and abroad
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RIVETT LATHE & GRINDER INC.
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Internal Spindle
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SEND US
YOUR
blueprints
Find out how
Tubing helps to make
better products, cheaper.
Machining parts from solid stock or forgings is a needless waste of time and materials . . . if Pittsburgh Steel Mechanical Tubing can be adapted to the operation. The advice of Pittsburgh Engineers—experts in the application of tubing to fabricating problems—is available to you without obligation. Let them study your blue-prints. Very often they can suggest tubing adaptations that will effect economies in machining time, tool wear, metal stock and power consumption. Send us your specifications for an opinion!

Pittsburgh Seamless

STEEL MECHANICAL TUBING

PITTSBURGH STEEL COMPANY · 1651 GRANT BLDG. · PITTSBURGH, PA.

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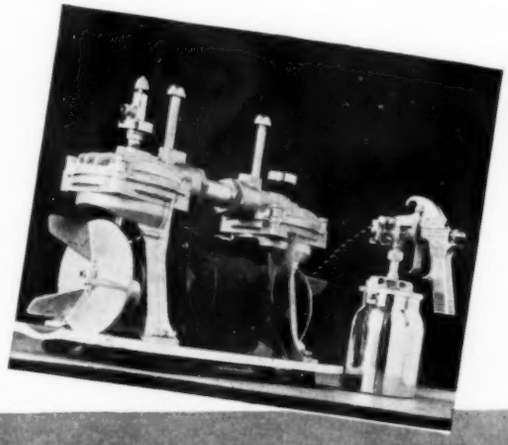
THERE IS NOTHING EQUAL TO SEAMLESS

Aluminum BECAUSE OF ITS LIGHT WEIGHT AND DURABILITY

Binks Manufacturing Company of Chicago wanted to produce an air compressor for paint spray work, which could be carried about easily. It had to be sturdy enough to withstand hard usage. They say, "Naturally, we turned to Aluminum."

The resulting unit, shown below without its streamlined cover, weighs only 44 pounds. It is carried like a small suitcase. The Alcoa Aluminum die castings pictured here are important contributors to its light weight and compact sturdiness.

The die casting process gives an accuracy of dimensions and a fineness of surface and details which greatly reduce fabricating time and costs. Have you investigated the use of Alcoa Aluminum die castings as a means of improving your product and cutting costs? Our engineers will gladly help you make such a study. ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh, Pennsylvania.



ALCOA ALUMINUM

BARDONS & OLIVER

THE NO. 2 GEARED ELECTRIC TURRET LATHE IS ENGINEERED FOR PRODUCTION AND PROFIT

•

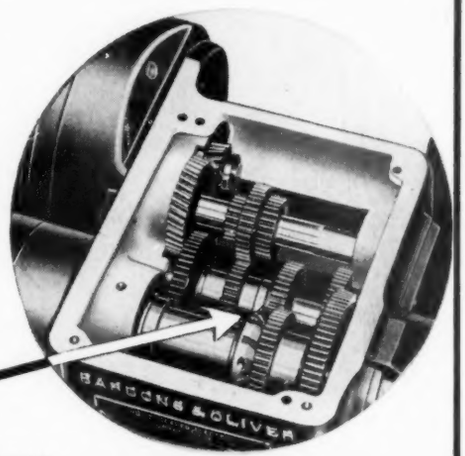
EACH OF THESE PROMINENT FEATURES IS DESIGNED TO INCREASE PRODUCTION AND FACILITATE EASE OF OPERATION . . .

SINGLE LEVER CONTROL for six spindle speed changes.

DIRECT READING SPEED DIAL with optional spindle speed ranges to suit individual requirements.

SINGLE LEVER ELECTRIC START-STOP-REVERSE and

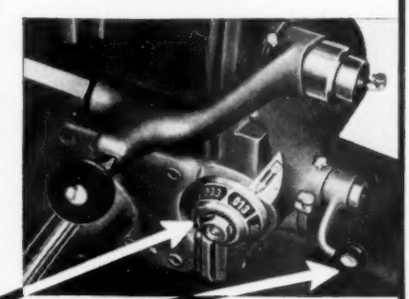
SINGLE LEVER ELECTRIC HIGH-LOW SPEED CHANGE with instantaneous, effortless response to the operator's touch.



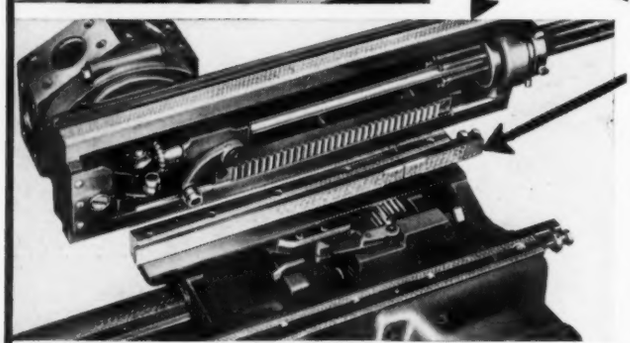
ALL GEARS FINISHED AFTER CUTTING BY THE CROSS AXIS SHAVING METHOD—the latest development for producing accurate, quiet running gears.

TURRET MOUNTED ON TAPERED ROLLER BEARING with large load capacity and life long accuracy.

AUTOMATIC TURRET CLAMP WITH AUTOMATIC WEAR COMPENSATOR.



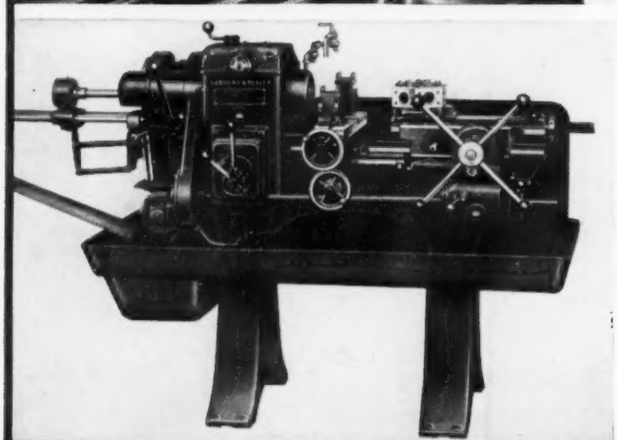
HARDENED ALLOY STEEL WEAR PLATES on both the bottom of slide and top of saddle.



DIRECT READING FEED DIAL with **SINGLE LEVER CONTROL** for six feed changes.

FLANGE TYPE HIGH TORQUE MOTOR eliminates belts, pulleys and idlers from drive.

ELECTRIC POWER BAR FEED AND AUTOMATIC CHUCK for semi-automatic operation.



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One of a series of advertisements featuring recent developments in Bardons & Oliver Turret Lathes.

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TURRET LATHES—CUTTING OFF MACHINES

Stop tools from turning soft... chipping... and burning—flood them with SUNOCO. Long service records prove SUNOCO prolongs tool life... reduces "down time" for resharpening... and steps up production per machine tool unit.

If you're interested in downing "down time" call in a SUN Engineer—let him show you why it's a long time between tool grinds with SUNOCO.

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PETROLEUM PRODUCTS FOR ALL INDUSTRIES

THREADING
THE MODERN WAY

. . . with "HANSON-PROCESS" TAPS visibly keen and correct

THE good points of Hanson-Whitney precision taps can be seen even before they are proved by performance in thread production.

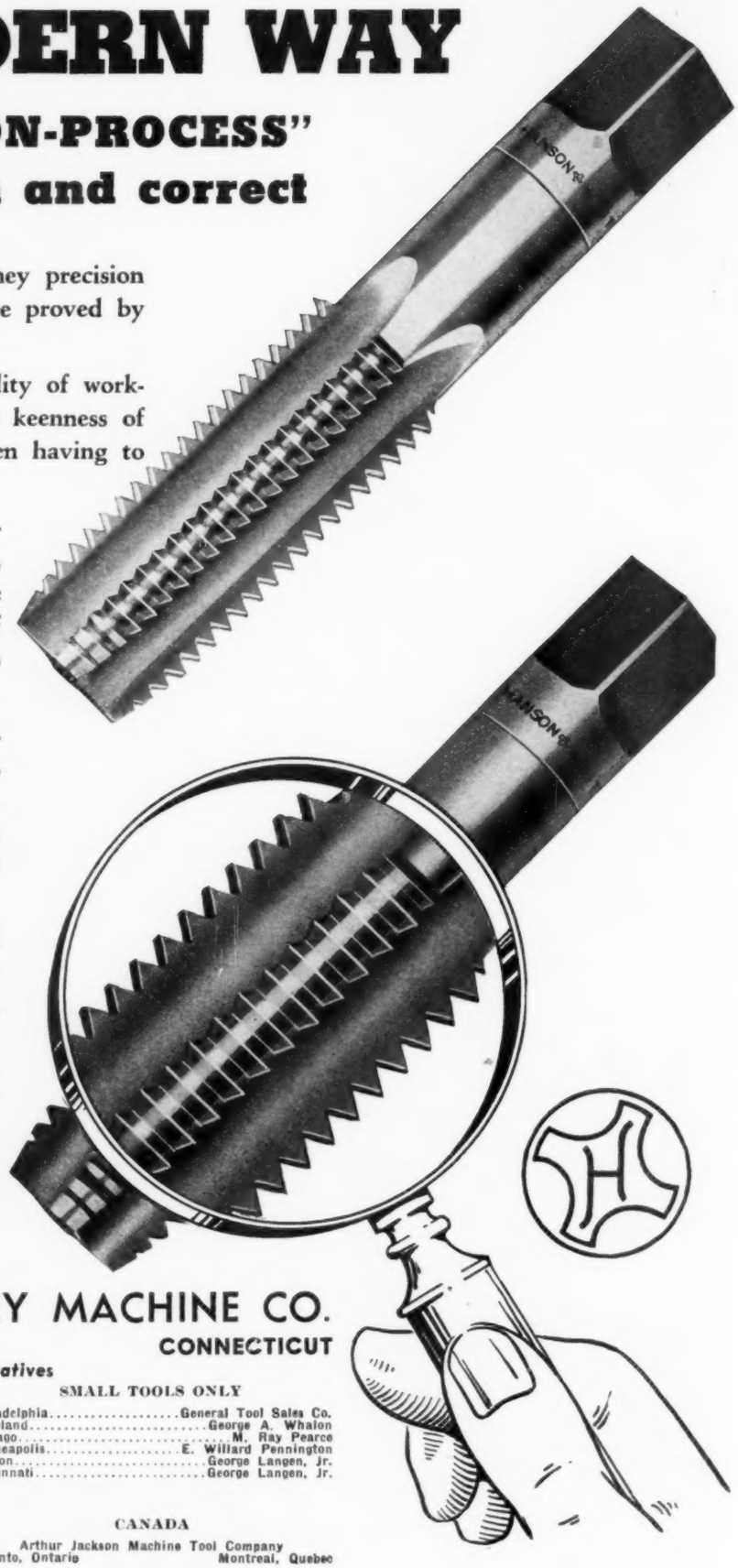
Under a magnifying glass the quality of workmanship is clearly visible. Note the keenness of thread edges so apparent without even having to feel their sharpness.

All these *visible* evidences of keenness and finish are the result of modern, scientific methods of machining and the exclusive "HANSON PROCESS" of finishing after hardening. H-W Taps are precision, long-lived tools.

In actual thread production, "HANSON PROCESS" TAPS give outstanding evidence of superiority in clean, accurate threads—in more threads between grinds—in longer service on toughest jobs.

Check H-W Taps for lead, angle and diameter. Then put them to work on the most difficult tapping operation in your shop. You, too, will agree that the modern, low cost way to tap threads is with "HANSON-PROCESS" TAPS.

Have you the latest "H-W" Precision Tool Catalog. If not, ask for a copy TODAY.



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HARTFORD **CONNECTICUT**

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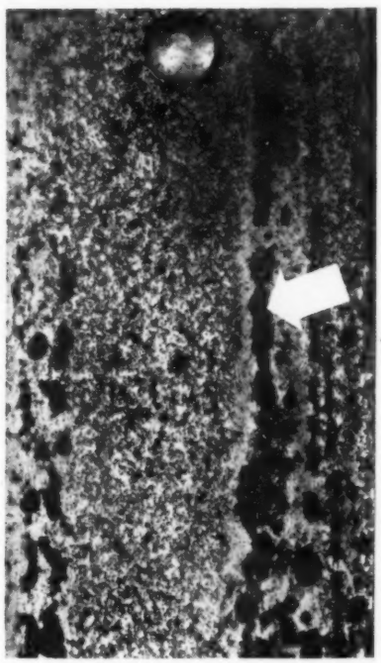
Arthur Jackson Machine Tool Company
Toronto, Ontario Montreal, Quebec

Use this
IMPROVED SLUSHING COMPOUND
to protect highly finished metal surfaces



Look at the Difference!

These two similar pieces of metal, one slushed with GULF OILCOAT NO. 1 and the other with a conventional slushing compound, were exposed to highly corrosive influences for the same length of time. The superior value of GULF OILCOAT NO. 1 is clearly demonstrated by the perfect condition of the metal plate on the left.

GULF OILCOAT NO. 1 is easily applied, long lasting and economical to use

YOU can now secure an improved material to protect highly finished surfaces of steel and nonferrous metal products against corrosion—GULF OILCOAT NO. 1. This product is an entirely new type of slushing compound, developed by Gulf technologists after many years of research and field tests.

While GULF OILCOAT NO. 1 provides a thin film which is not easily rubbed off by handling, it may be readily removed by conventional solvents. Accelerated laboratory corrosion tests, as well as field tests with all types of metals have established the superiority of this new type of slushing material over products formerly used for this purpose.

GULF OILCOAT NO. 1 can be applied by any conventional method and lasts for a long period of time. It is nominally priced and economical to use. Ask the Gulf representative who calls on you to give you further details—or fill in and mail the coupon below for complete information.

GULF INDUSTRIAL LUBRICATION

FILL IN AND MAIL THIS COUPON

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Gulf Oil Corporation—Gulf Refining Company
Room 3813, Gulf Building, Pittsburgh, Pa.

Please send me complete information and price quotations on GULF OILCOAT NO. 1.

Name .....

Company .....

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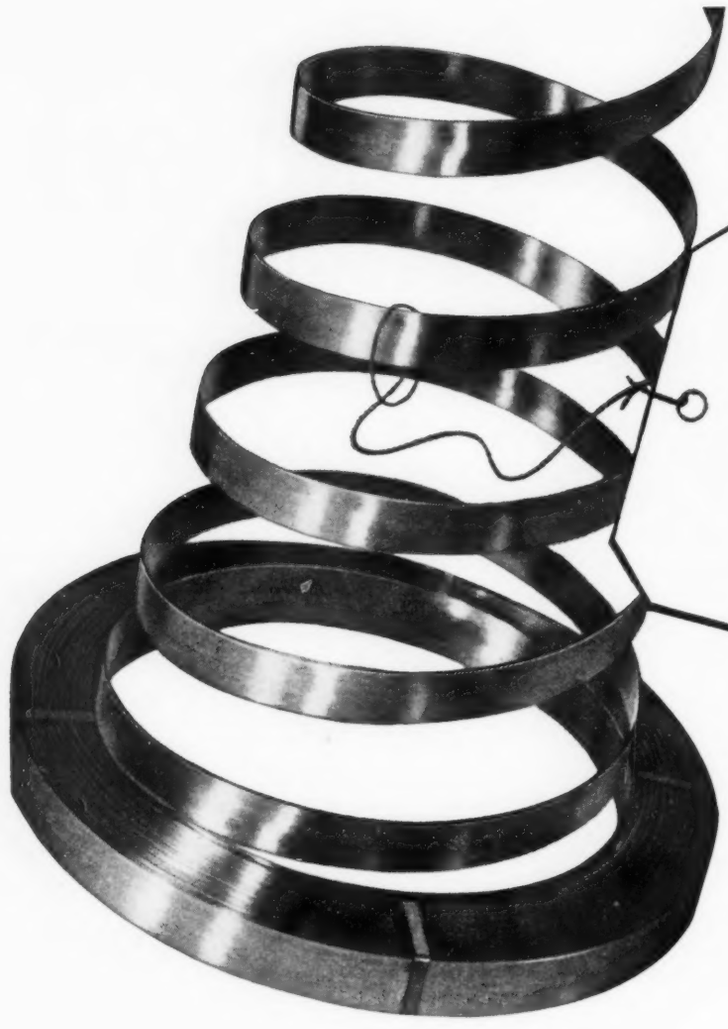

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UNVARYING HIGH QUALITY

IS THE STRICT REQUIREMENT HERE!

This Roebling Cold Rolled High Carbon Steel "Flat" must be unfailingly dependable in service. It is ordered to very rigid specifications covering temper, tensile strength, flexibility and other characteristics.

For one thing, the temper of this flat wire is uniform and is kept within very close limits. The wire is straight throughout, possesses great tensile strength, is highly flexible and can be bent without fracturing. And there must be no variation in its high quality. Finish—tempered, polished, straw-colored or blued.

If you require either high or low carbon cold rolled steel flat wire to meet exacting requirements, we would welcome an opportunity to serve you. We have specialized in this class of business for over 40 years and have unusual facilities to handle it. Write or phone us and we will gladly send you our catalog, samples, or information and prices covering flat wire made to your specifications.

TYPES:—Roebling Cold Rolled Flat Wire is made from both high carbon and low carbon steels, produced in Roebling's own mills. The high carbon flat wire is available in tempered and untempered types.

FINISHES:—bright, black annealed, bright annealed, tinned, japanned, galvanized, blued, straw-colored, and coppered.

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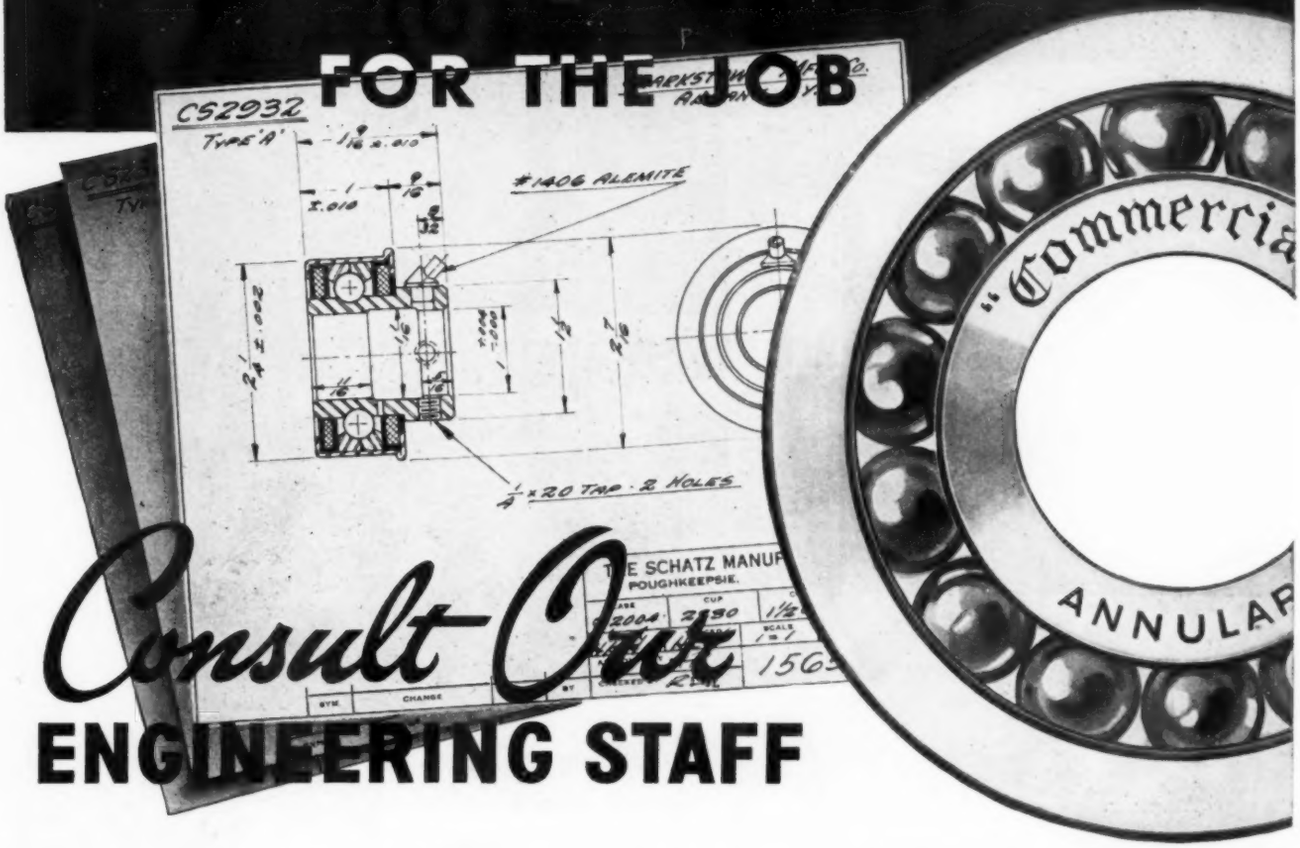
COLD ROLLED STEEL FLAT WIRE—TO MEET EXACTING REQUIREMENTS

GET THE *Right* BEARING FOR THE JOB



Consult Our ENGINEERING STAFF

WE maintain an Engineering Department—competent and experienced Engineers who will be glad to co-operate with you in the selection of the *right* bearings for the job. This is part of **"Commercial"** Annular Ball Bearing Service and is available to all users, or prospective users of ball bearings. The recommendations of our Engineers will aid you in solving bearing problems and implies no obligation whatsoever.

"Commercial" Annular Ball Bearings are made by experts in a large, modern plant. High grade steels, carefully heat-treated, plus precision manufacture result in QUALITY bearings capable of withstanding unusual shocks and strains under the most trying conditions . . . write for details and latest catalog.

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SPEEDS UP TO 2500 R.P.M.
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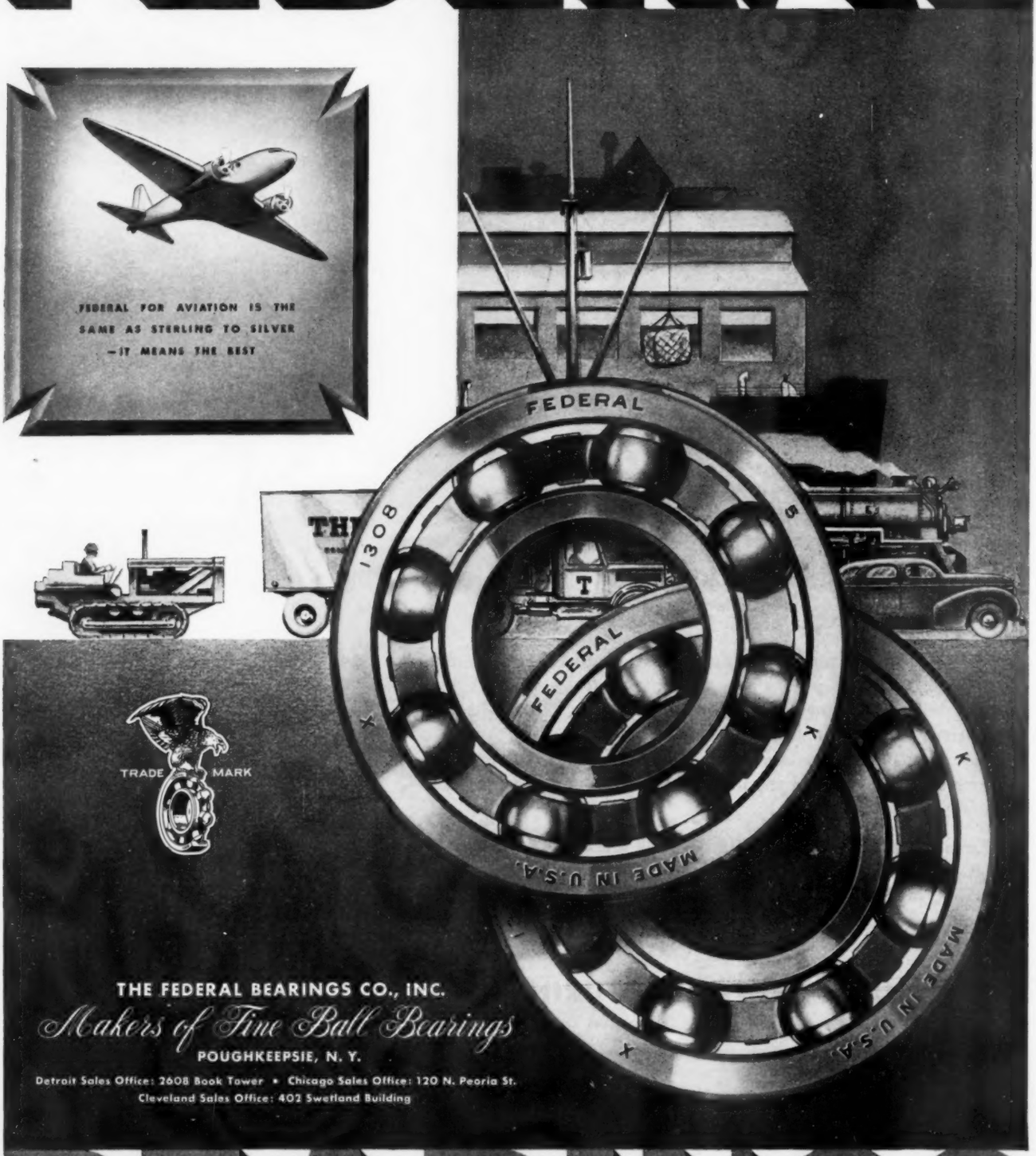

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For DEPENDABLE MACHINE TOOL PERFORMANCE

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WAGNER CP MOTORS

If the motor fails, the machine tool stops, and production is interrupted. Repairing or replacing. the motor costs money, and the loss of valuable production time is expensive. As a result, operating costs go up — production goes down; two things you do *not* want to happen.

And they won't happen if you use Wagner CP totally-enclosed fan-cooled motors, specially designed for machine-tool service. Wagner CP motors, on account of their two-frame construction, are self-protected against steel filings, chips, metal dust, and cutting oils — agents which soon cause breakdowns in ordinary motors if used where these conditions prevail.

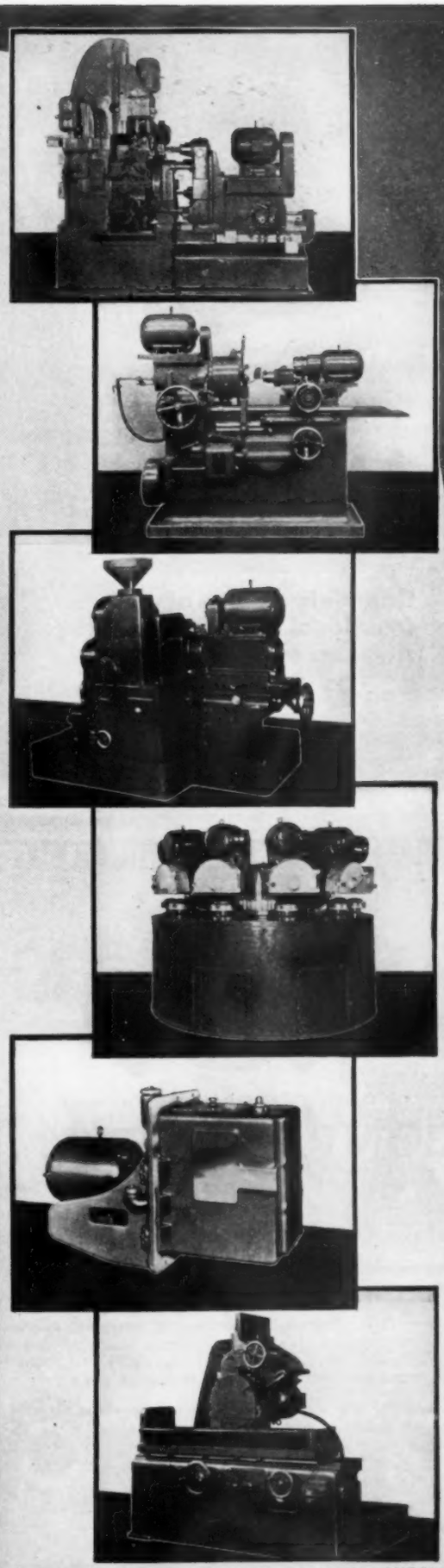
For example, in any machine shop there is metallic dust in the air which collects on the windings of open motors, and may cause short-circuits or grounds — but not the finest particle of this dust can enter the windings or bearings of Wagner CP motors, because the inner frame completely seals the vital parts of the motor against the entrance of all such destructive agents. Hence, Wagner CP motors give continuous, uninterrupted service year after year.

With Wagner CP motors on the job, operating costs go down — production goes up; two things you *do* want to happen.

Get the complete story on Wagner CP Motors — write for descriptive literature.

Ask for bulletin 182. It contains complete technical data on Wagner CP totally-enclosed fan-cooled motors.

Production goes up — overhead goes down when Wagner CP motors go on the job.



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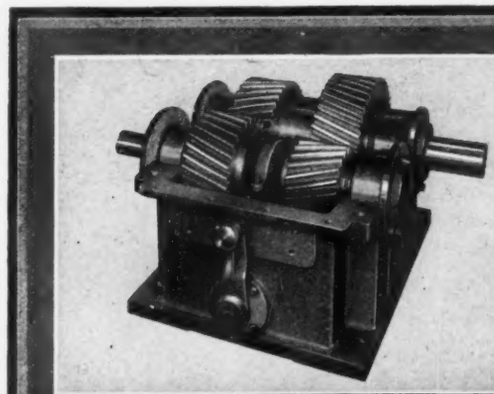

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Complete ranges of sizes from fractional to 100 h.p. Reductions up to 4000 to 1.

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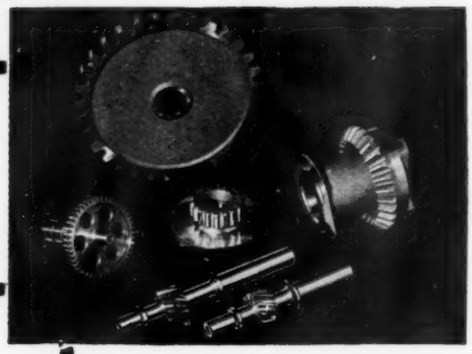

Send us your specifications. Ask for estimates on any type or quantity.

You can depend on precision work to your most exacting specifications when you make Perkins responsible for the production of your worm, helical, spiral and bevel gears.

High precision and uniformly high quality are duplicated on every order for Perkins Gears regardless of the quantities involved.

As specialists in gears for precision work, Perkins offers you Custom Cut Gears that insure the utmost in efficiency, long service and economy.

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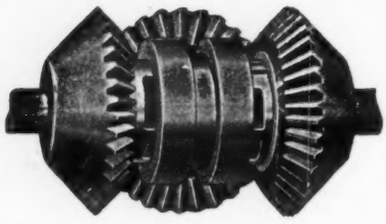
THE JOHNSON FRICTION CLUTCH



Double Clutch between Bevel Gearing

COMPACTNESS . . .

is only one of the reasons why many leading manufacturers of machine tools have made the Johnson Friction Clutch an integral part of their product.

Our experts have engineered into the Johnson Clutch a responsiveness far beyond anything you have ever known in clutch usage. Their smooth action in picking up the load — their dependable service in carrying overloads without slipping or vibration—assure long life and low maintenance cost; not only for the clutch itself but for the entire machine to which it transmits power.

If you are not already profiting by the use of Johnson Friction Clutches, our engineers will be glad to cooperate with your own engineers in working out the most effective and economical method of application.

MODERN GROUP DRIVE

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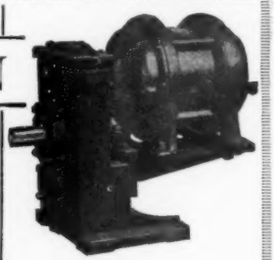
Equipped with Timken Bearings and Helical Gears. Made in sizes for motors from ½ to 15 hp. Ratio from 2½ to 1 to 1014 to 1.



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GANSCHOW GEARS

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Our facilities include the most modern types of equipment for the production of all types of gears and pinions in any material or quantity. We are fully equipped to produce gears which involve cutting, grinding and heat-treating operations.

An estimate on your gear requirements will convince you that Braun offers an economical service. You can also depend on Braun for prompt deliveries in any quantity.

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EACH GEAR A MASTER GEAR

and the way MEISEL builds gears, there's just one **right** gear for any specific job. Designed for use under conditions that exist, MEISEL Gears actually "belong" to a machine . . . are inherently able to give longer, quieter, more economical service. Investigate the advantages of **specifically** engineered gears by MEISEL.

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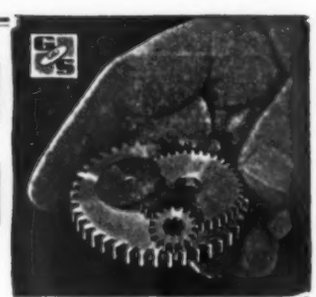

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In a restricted sense it refers to the function of Allen screws, — holding machine-parts together, more strongly than ever. It implies a necessary condition to *uninterrupted production.*

In a larger sense, "HOLD STRONGLY TOGETHER" applies to all manufacturing organization and to industrial polices. To cooperation between Management and Labor. To economic solidarity.

In its broadest sense it is a slogan of national UNITY, — for to national unity we all contribute by *"holding together".*

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The Allen screw, in a great machine is relatively a little thing. But in service it worthily exemplifies the Big Thing.

Your local Allen Distributor provides prompt, accommodating service.

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New 1/10,000" Indicator
Model C-10

Range	3"
Diameter of case	1 15/16"
Diameter over all	2⅛"
Depth of case	⅞"
Length over all	3½"
Lug or Bracket—Offset, on center if desired	Hole 3/16"
Back held in position by	4 large screws
Center of spindle to center of hole in lug	15/16"
Weight	8 ounces
Stem	9/32 diam.
Dial	0-5-0 or 0-10
Graduated	.0001
Crystal	Non-breakable

Model C-10

RANDALL & STICKNEY
Waltham, Mass., U. S. A.
Makers of Gauges Since 1885

SMALL GEARS
ALSO MEDIUM SIZES IN ALL TYPES AND MATERIALS
Hobbed Pin Rod, Spur, Spiral and Worm Rod
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Manufactured by
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As a wear-resistant material, Carboloy is employed in the form of inserts in machines and products subject to excessive localized wear. Hydraulic equipment, fish rods, food machinery, oil well pumps, textile machines, etc., are a few of the diversified machines and products doing a better job because Carboloy "inserts" guard against destructive wear.

As a die material, Carboloy draws wire, bar, tubing and sheet metal; sizes bars, bolts, nuts, etc.; extrudes such things as carbon resistors and other abrasive products; coats welding rods, automobile tire bead wires, etc.

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In 1940 let Carboloy help to step up production and step down costs on every possible process in your plant. Carboloy Company, Inc., 11149 E. 8 Mile Road, Detroit, Michigan.

The Mark of CARBOLOY

CARBOLOY

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FOR CUTTING, DRAWING, SHAPING, EXTRUDING METALS AND NON-METALLICS

★ FOR REDUCING WEAR ON EQUIPMENT OR PRODUCTS YOU USE OR MAKE ★

GLUTTONS

for

Punishment

Pat's. Pend.

Fig. 1434 Knurled "Unbrako" Socket Head Cap Screw with the "Better Gripping Head"

Fig. 232 "Unbrako" Hollow Set Screw

Pat's. Pend.

Fig. 1446 "Unbrako" Socket Head Stripper Bolt with the "Better Gripping Head"

UNBRAKO

SOCKET SCREWS

For sheer strength and gripping ability "Unbrako" Products simply can't be exceeded. Incorporating the advantages of stronger, tougher alloys, improved methods of heat treating and uniform accuracy of manufacture, "Unbrako" Socket Screws should be specified if you want the best at the fairest price.

Knurled "UNBRAKO" Socket Head Cap Screws

Knurled heads speed production by their better grip —also provide easy and positive locking feature.

"UNBRAKO" Hollow Set Screws

Points won't mushroom—hex won't round. An old stand-by in countless plants.

"UNBRAKO" Socket Head Stripper Bolts

Socket heads allow more compact design—knurling gives mechanic a better hold.

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Worn Standards Result In Production Losses

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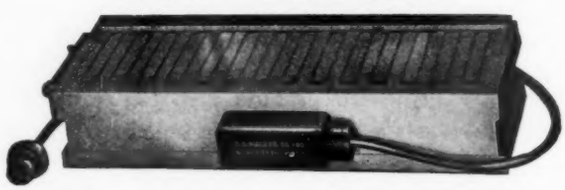
WALKER



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Provide quick and easy change of work

Savings of from 20% to 50% in chucking labor are realized through the use of Walker Magnetic Chucks.

These modern powerful chucks eliminate the necessity for slow acting jigs and fixtures for many operations on lathes, shapers, drill presses, planers, grinders, etc.

Walker Magnetic Chucks—available in many designs and types—will help you put your machine tools on full time work by turning set-up time into productive time.

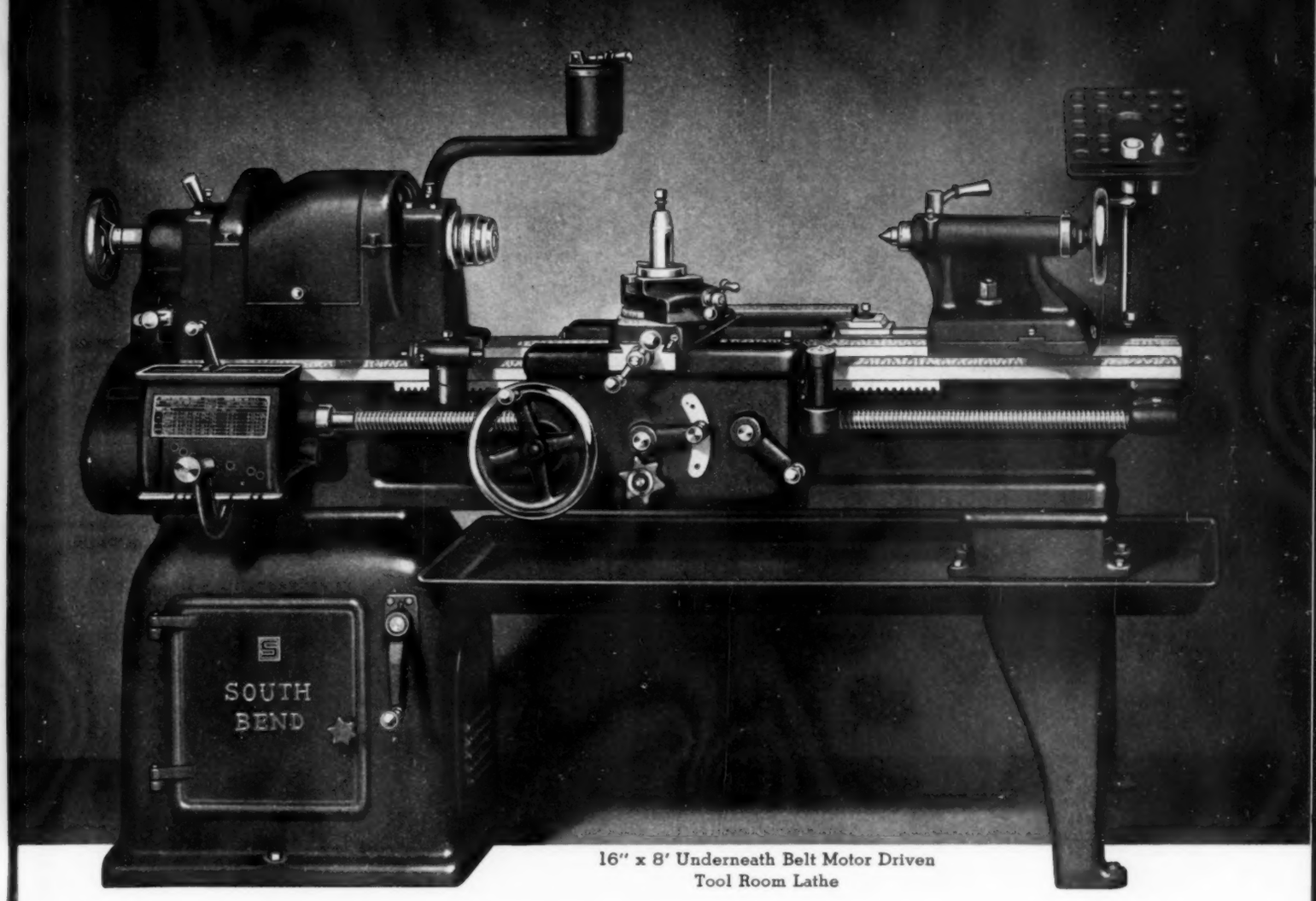
Write for detailed information.

Illustration above is of the Walker No. 618 all steel magnetic chuck—available in sizes from 4"x8" up to 30"x56".

O. S. WALKER CO.

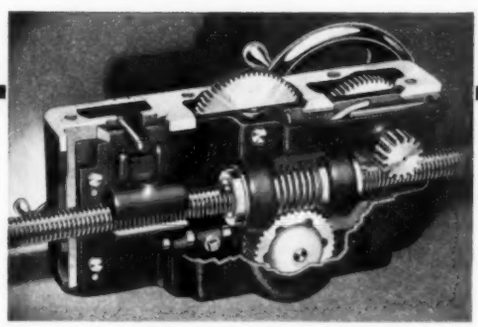
WORCESTER, MASS., U. S. A.

Walker Swivelling Type Magnetic Chuck—new in design with central control. Available in lengths up to 17'.



16" x 8' Underneath Belt Motor Driven
Tool Room Lathe

SOUTH BEND LATHES FOR PRECISION WORK



Double Wall Apron

Back view of the Double Wall Apron showing the rigid, one-piece box type construction that provides a substantial support for both ends of the gear shafts.

Gears in the apron are of steel and have a reservoir and felt wick automatic oiling system. Worm drive assures smooth operation of feeds on all classes of work.

A powerful multiple disc friction clutch operates both the Automatic Cross Feeds and Automatic Longitudinal Feeds. A slight turn of the clutch knob instantly engages or disengages the clutch.

South Bend Lathes have been giving thousands of users dependable service on the most exacting classes of precision machine work for more than thirty years. Sound design, the most expert workmanship and the best materials available are combined in South Bend Lathes to give them permanent accuracy and efficiency.

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Manufactured in 9", 10", 11", 13", 14½" and 16" swing, bed lengths 3' to 12', in Motor Drive and Countershaft Drive. Attachments are available for production, tool room and general machine work.

New South Bend Lathe Catalog

Write today for a copy of our new 112-page lathe catalog describing all Sizes and Types of South Bend Lathes, chucks, tools and attachments.

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Popular sizes of South Bend Lathes are carried in stock for prompt delivery and demonstration by machinery dealers in 477 of the principal cities of the world. A few prominent distributors displaying South Bend Lathes are listed below. Write for name of the dealer nearest you.

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LATHE BUILDERS SINCE 1906

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TRADE MARK SOUTH BEND TWIN SPINDLE ENGINE LATHES

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DO YOU JUST BUY TAPS *or* DO YOU LOOK FOR BETTER TAP PRODUCTION?

For 65 years, Card has solved many problems for tap users. Outstanding advances in tap making and tap design have enabled Card to offer superior quality tapping as well as faster work—benefits that you, too, can realize through putting the right Card Taps to work on your production tapping.

Why overlook possibilities for improvement in tapping by just merely buying taps. Call on Card engineers to help you select the taps that will assure better performance.

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Card Taps are sold by leading dealers everywhere

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WALTHAM CYLINDRICAL SUB-PRESSES

may be procured without dies. Nine sizes in both arch and overhang types are kept in stock. Ask for folder giving dimensions and prices.

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Ruthman Gushers

The same dependability in service for which Ruthman Gushers are so well known as coolant pumps is offered in the handling of non-lubricating liquids.

Design of Ruthman Gushers is such as to eliminate metal-to-metal contact. Thus lapping, honing and grinding compounds can be handled safely and dependably. Furthermore the Ruthman is not injured by small chips and grit—in fact strainers are not necessary.

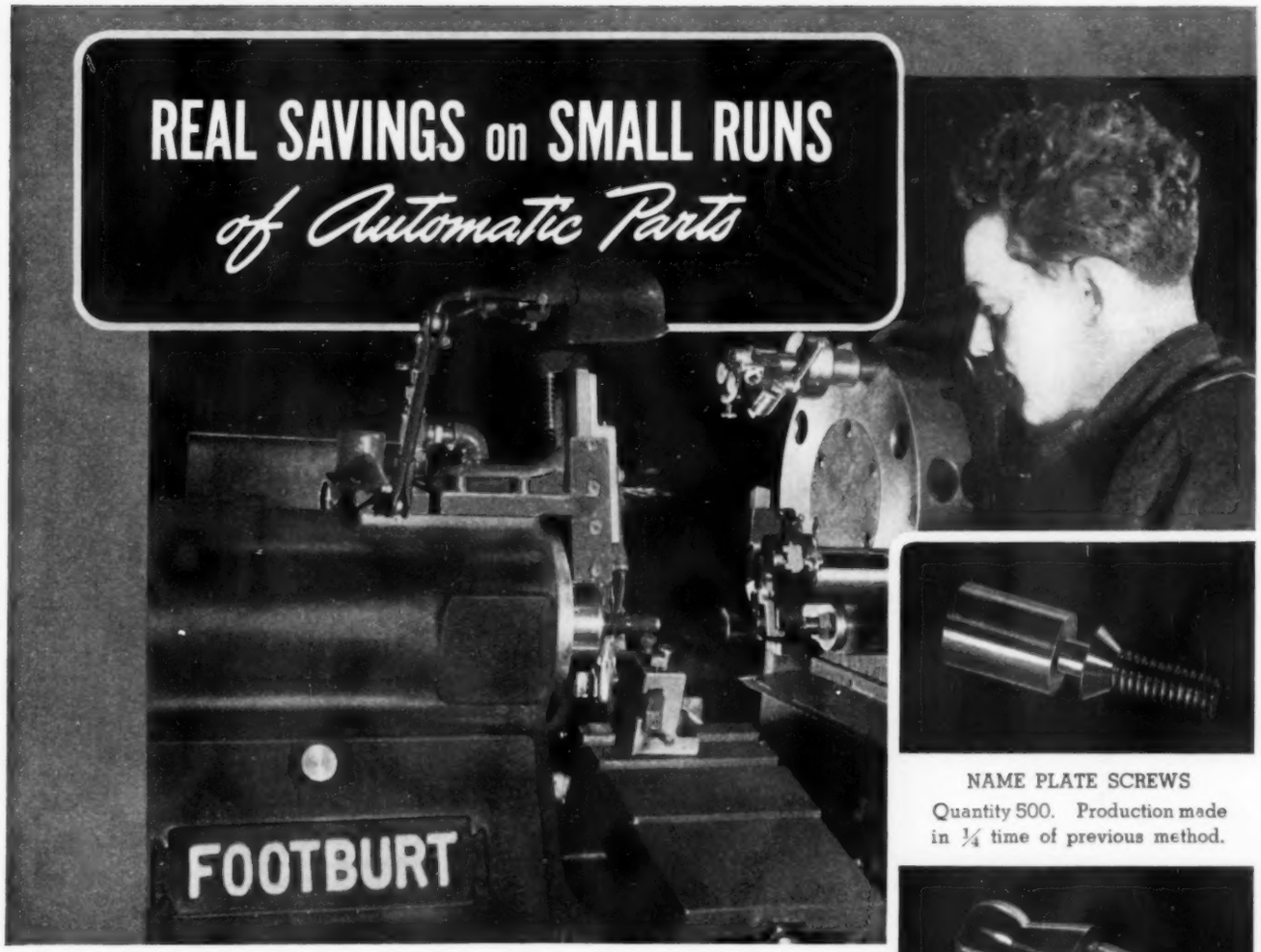
There are many features and advantages offered by Ruthman Gushers well worth investigating. It will pay you to get all details.

The Ruthman Machinery Co.

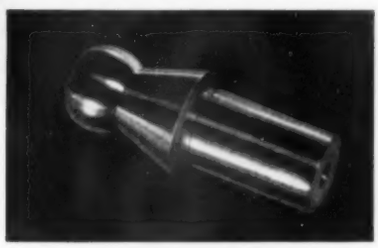
201 PIKE STREET CINCINNATI, OHIO

"Standard and Special Pumps for Every Job!"

REAL SAVINGS on SMALL RUNS *of Automatic Parts*



NAME PLATE SCREWS
Quantity 500. Production made in ¼ time of previous method.



PAWLS
Quantity 300. Production made in ⅓ time of previous method.

CLAMP BUSHING
Quantity 600. Production made in 1/5 time of previous method.

★ **On many short runs the Footburt Single Spindle Automatic is showing remarkable cost savings. With simple hydraulic adjustments, the machine can be set up quickly; it is not necessary to make cams. Hydraulic control speeds up indexing and rapid traverse, greatly reducing idle time. We will be glad to figure with you on typical items of your production.**

THE FOOTE-BURT COMPANY

CLEVELAND, OHIO

Detroit Office:
4-151 General Motors Bldg.

Chicago Office:
565 Washington Blvd.

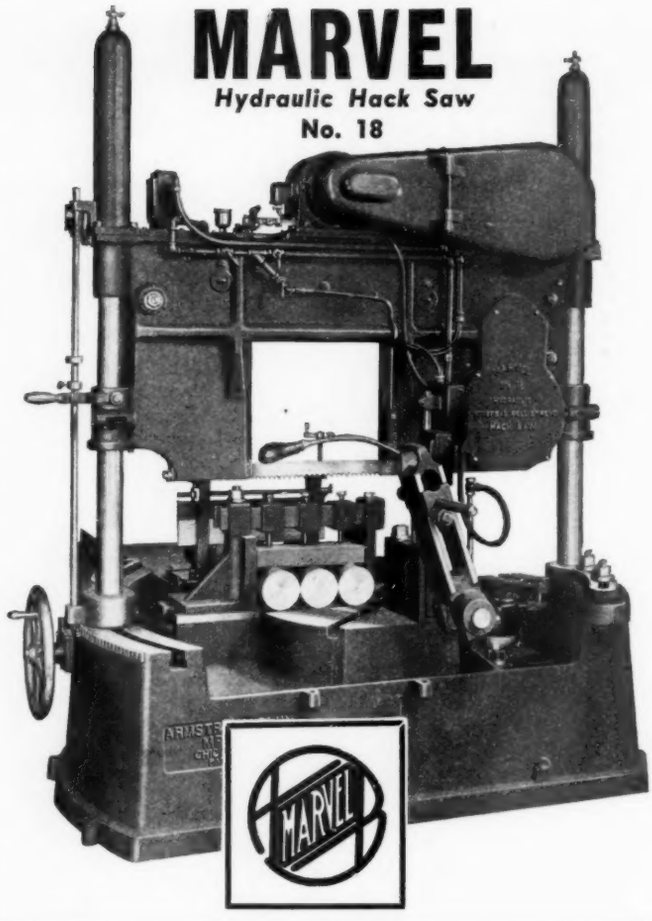
FOOTBURT *Automatic* **SCREW MACHINES**

a GIANT IN CAPACITY IN RUGGEDNESS IN POWER IN PROPORTIONS

MARVEL

Hydraulic Hack Saw

No. 18



● Here is a new giant hack saw for doing a giant's work —the MARVEL No. 18. Swing an 18"x18" billet or bar of the toughest steel into the MARVEL No. 18 and under its smooth hydraulic feed, its chip-clearing roll-stroke action, it will cut it down with unbelievable ease and speed.

● Here is a saw that takes "all comers" and will stand up to continuous operation on the heaviest work. Armoured, with all moving parts protected, it is not endangered by the thumps and knocks incidental to handling large work. It is a tough powerful unit, yet handles like a baby with its trouble-free, low pressure hydraulic feed and quick traverse. For large sizes and tough steel it is unequalled in speed, accuracy and economy.

● *Write for full information.*

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5747 Bloomingdale Ave. **Chicago, U.S.A.**

Eastern Warehouse and Sales: 199 Lafayette St., New York.

-A New

ROTARY MAGNETIC CHUCK

Permanent Magnet Type

— No Electric Current

required . . . . . Permanent magnets have strong holding power — last indefinitely . . . . . Unusual convenience and economy — No wires — No heating — No running costs

—Ask for circular on Rotary and Rectangular Models
Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

BROWN & SHARPE

ERRINGTON

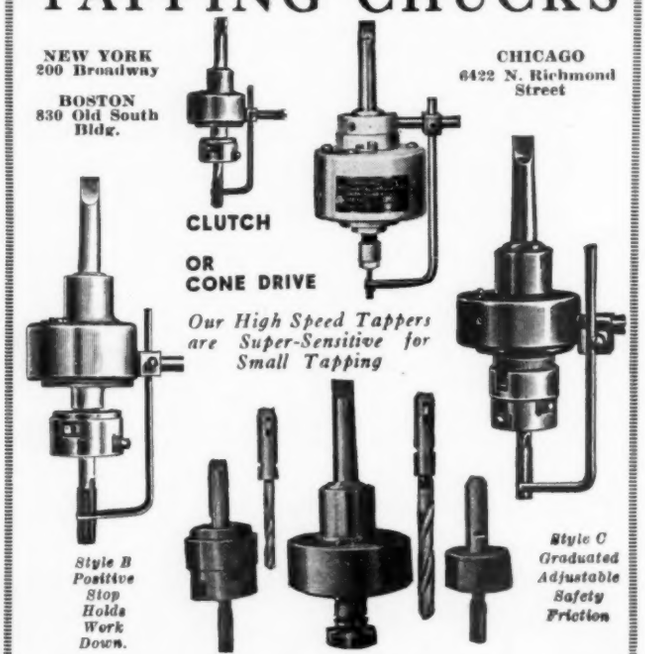
Main Office and Works, Stapleton, Staten Island, N. Y.

TAPPING CHUCKS

NEW YORK
200 Broadway

BOSTON
830 Old South Bldg.

CHICAGO
6422 N. Richmond Street



CLUTCH

OR
CONE DRIVE

Our High Speed Tappers are Super-Sensitive for Small Tapping

Style B Positive Stop Holds Work Down.

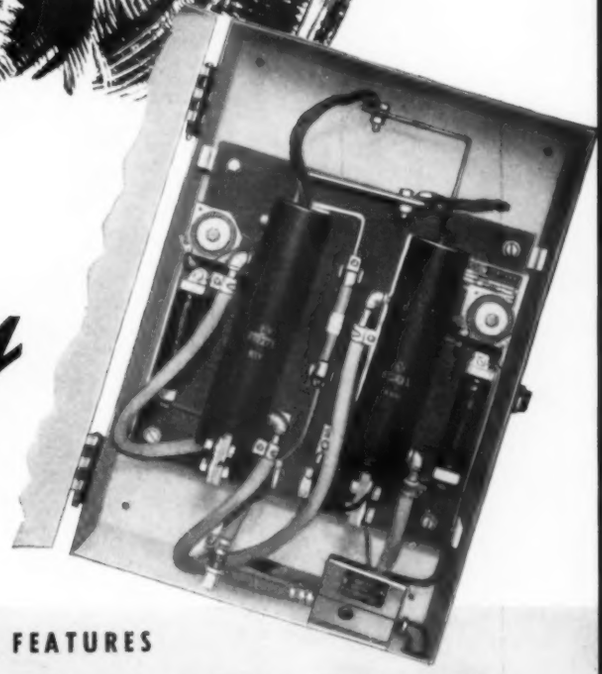
Style C Graduated Adjustable Safety Friction

DRILL PRESS TURRET

Style D-E with Quick-Change Tool Holders to Drill, Tap and Set studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustments in each tap-holder, if required.

Also, Opening Die-Heads; Opening Stud-Setters; Friction Screw-Drivers and Nut-Setters, etc.

Since we installed Ignitron Contactors for our spot welders we've had a *Maintenance Holiday*



WHEN G-E ignitron contactors are installed to control spot welders, maintenance costs "nose dive." That is easy to understand, because there are no moving parts in this new control. It makes and breaks welding currents silently—without destructive arcing or hammering.

One large automotive manufacturer, who uses 70 of these contactors for portable spot welders, reports exceptionally fine results during the first year of operation. Maintenance costs have been exceedingly low and "time out" negligible, in spite of severe duty. Based on experience, ignitron tubes used for welder service will operate for an average of two to three years without attention.

This contactor is *easy to install.* Simply connect it in place of your present contactor and connect a water supply for the ignitron tubes. The contacts on your present timer will operate this contactor just like any other welding control.

If you now use, or are planning to install, spot welders, we'd like to send you a copy of our new bulletin describing the ignitron contactor. It explains just how *you* can save on welder maintenance.

FEATURES

Millions of operations without servicing
No moving parts
High-speed operation
No contacts to inspect
Silent in operation
Easy to install with any welding machine

General Electric, Dept. 6B-201
Schenectady, N. Y.

Please send me publication GEA-3058A, which gives complete details about this silent, low-maintenance ignitron contactor.

Name .....

Address .....

.....

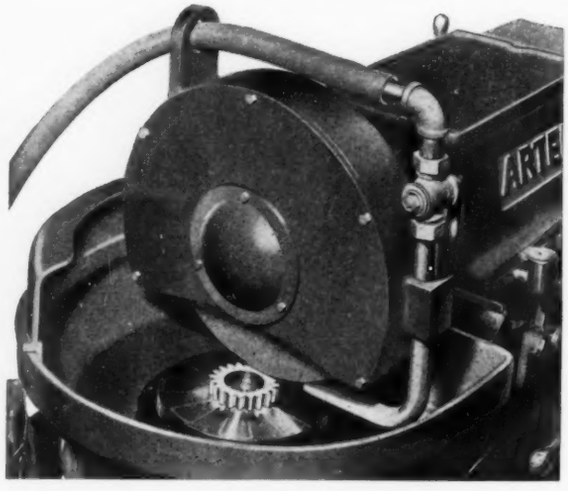
080-202

GENERAL ELECTRIC

ARTER

Model A Rotary Surface Grinder

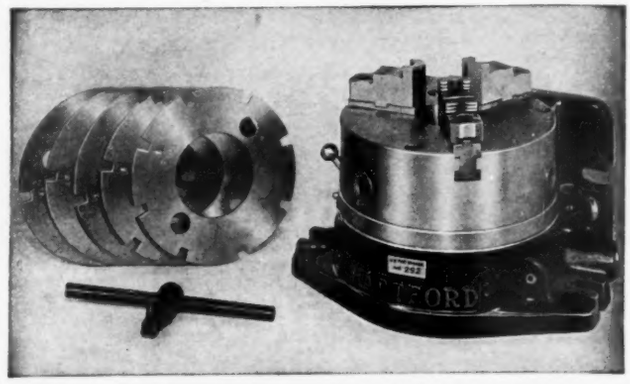
8"-12"-16" sizes



In tool-rooms or in production lines Model A grinders have established a reputation for quality work. The great vertical capacity and a tiltable work table are notable features. Grinding the angular sharpening face of gear shaper cutters is a typical job.

ARTER GRINDING MACHINE CO.

WORCESTER, MASS. U. S. A.



THE HARTFORD SUPER-SPACER insures rigid control of accurate work

Speed, accuracy and rigidity are combined in the Hartford Super-Spacer to assure worthwhile savings on machining operations where spacing is involved. Mask plates insure against all chance of error in indexing.

The Hartford Super-Spacer will speed up milling, drilling, slotting and planing — reduce setup time — insure the handling of operations at speeds and feeds limited only by the capacity of the holding means and the power of the machine tool on which it is used.

By using the Drilling Attachment which is easily secured to the base, the Super-Spacer becomes a fast and accurate device on drill jig and layout work.

INVESTIGATE NOW! BY WRITING FOR COMPLETE DETAILS

THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD, CONN.

GOT ANY NEW CONTRACTS?

• Get the greater precision necessary to fulfil some of the new contracts. Keep the precision of these new production set-ups with Johansson Gage Blocks—unexcelled for accuracy. Johansson Blocks can be bought separately or in a variety of sets. Inexpensive, yet indispensable for supreme accuracy.

All Johansson Gage Blocks can be obtained chrome-plated.

Write for the free catalog of Johansson's low prices, precision accessories, complete list of convenient sets.

Set. No. 1. These 81 blocks combine to form 120,000 different size gages, in steps of .0001 inch, from minimum size .200 inch to more than 12 inches. Accurate to within ±.000008 in., ±.000004 in., ±.000002 in.

FORD MOTOR COMPANY

Johansson Division, *Dept. B* Dearborn, Michigan

Please send me, free, Catalog No. 14.

*Name*_____

*Address*_____

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McGRAW-HILL

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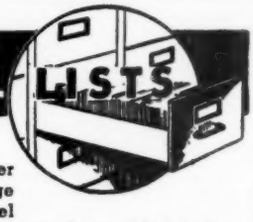

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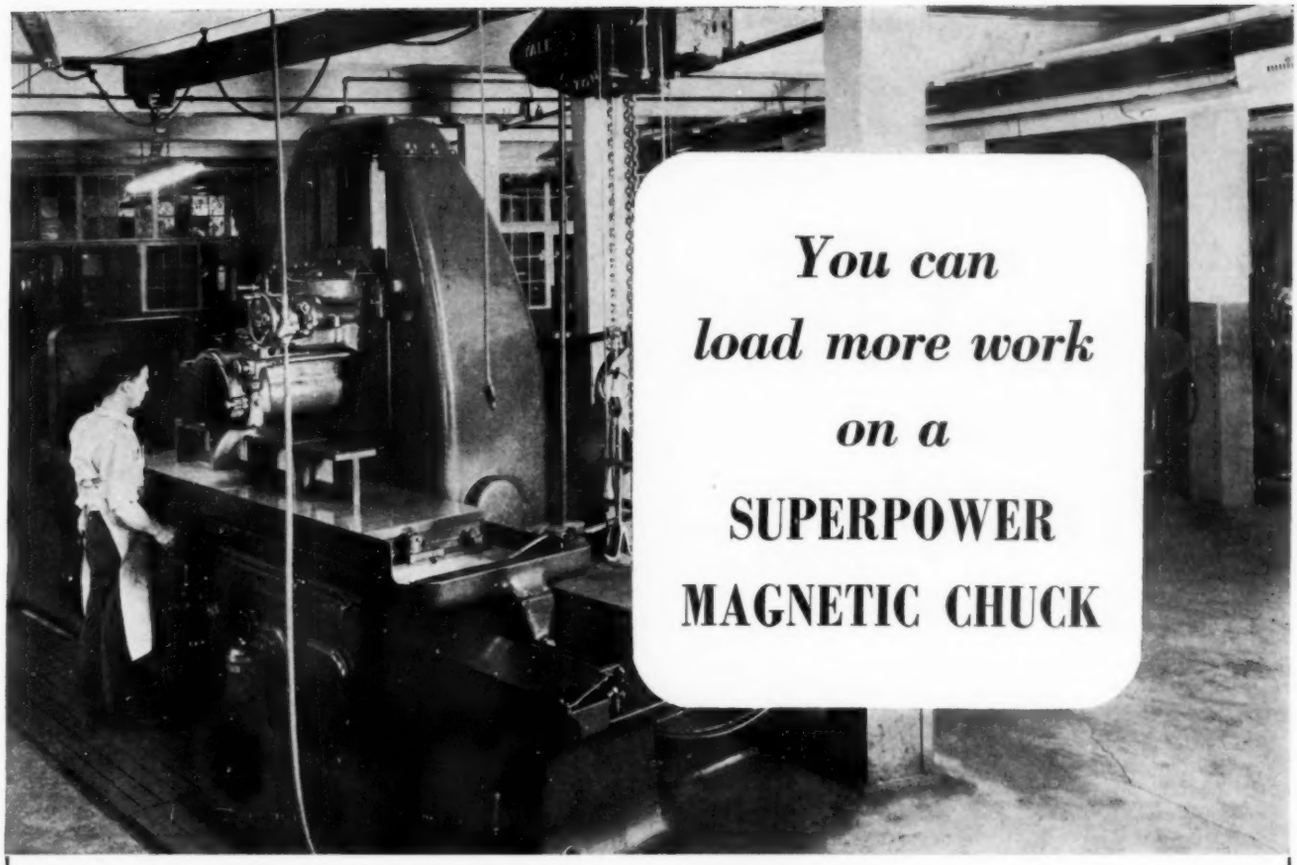
. . . Complete lists covering industry's major markets



You can load more work on a SUPERPOWER MAGNETIC CHUCK

THERE'S a much more powerful *pull*, over a much greater active area. And that means *extra holding power* to handle today's high speeds and heavy feeds.

Extra machine-capacity, too, is provided by Superpower's maximum clearance under wheel or tool. And the fine-mesh faceplate (when ordered) handles smaller pieces . . . as for instance, 4000 small washers per load. Also, work-range can be extended to irregular-shaped parts by use of Taft-Peirce Magnetic V-Blocks and Parallels (*see the T-P Handbook*).

No other magnetic chuck approaches these advantages . . . or matches the heavy-duty, waterproof durability of Superpower. It will cost you *nothing* to see for yourself how the world's finest magnetic chuck can increase the output of *your* grinders, millers, planers, shapers. You are welcome to experienced engineering counsel, without charge. *Just write.*

THE TAFT-PEIRCE MFG. CO.

WOONSOCKET, RHODE ISLAND

New SUPERPOWER PRODUCTS

TAFT-PEIRCE MAGNETIC CHUCK
Style 512

For use on the Taft-Peirce No. 1 Precision Surface Grinder . . . and all other makes and models of small surface grinders. Fine-mesh faceplate holds extremely small work *directly*, without adapters. Made in 110 and 220 volts, D. C. *Write for complete details and prices.*

TAFT-PEIRCE DOUBLE-UNIT DEMAGNETIZER
Style 9801-2

Of larger capacity than the original *Superpower* AC type, this double unit is built with the same characteristics as the single-unit. Plug into any light socket or AC source. Furnished connected for either 110 or 220 volts, 60 cycle single-phase AC 130 watts. *Write for prices.*

Always meant a lot . . .

NOW MEANS MORE THAN EVER BEFORE . . .

The improved emblem of The Associated Business Papers is symbolic of its greater significance to advertisers. ¶ Its *Standards of Practice*, guide-posts of ethical business paper publishing for twenty-three years, have this year been made stronger and more enforceable than ever before. ¶ Apace with the times, its member publications are constantly making their editorial pages more dynamic . . . increasing their hold on their reader-audiences. ¶ Singly in relation to your markets, and collectively as an association, these modernized A·B·P-A·B·C publications deliver an abundance of what it takes to produce resultful advertising.

AMERICAN MACHINIST

Member of The Associated Business Papers, Inc.

ANNOUNCING!

THE NEW 8″ PORTER-McLEOD COLD METAL SAWING MACHINE

This new machine—modern, clean lined, compact and enclosed motor driven—offers ample power and convenience of control to meet every requirement of speed, versatility and economy.

Features are included which make this machine adaptable for general work and for production work in single and multiple units. Capacity is such as to permit of "nesting" economical quantities of bars or shapes using our systems of "multiple or interchangeable" nests which give support to each nest on both sides and bottom. Clamping pressure is exerted at the top. Rigid holding of all bars in the nest is definitely assured. For instance, 3 pieces of Round Stock 4½″ dia. can be cut at one time and smaller sizes in greater quantity.

In addition, the new 8″ PORTER-McLEOD offers: adjustable blade support, allowing the use of blades of different thicknesses; protection of blade against riding or bumping the stock, friction disk feed which insures against blade breakage; a design which pulls the blade through the cut in such a way as to eliminate weaving and buckling. Write for new bulletin giving complete details.

GENERAL SPECIFICATIONS

Drive: 5 hp. motor — at 1800 rpm. Equipped with magnetic switch and push button control. Standard blade diam. — 20″, giving speed of 5311/2 ft. per min. 18″ diam. blades can also be used. Feed on standard machines is 0″ to 3″ per minute; 1½″ or 4½″ available on order on standard machine. Special speeds and feeds can be provided to suit special conditions.

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASSACHUSETTS, U. S. A.

CONTRACT WORK

TOOLS • DIES • JIGS • FIXTURES • MOLDS • STAMPINGS • FORGINGS • SPECIAL MACHINERY • DEVICES • PARTS • SCREW MACHINE PRODUCTS • CASTINGS

Special Machinery, Dies, Tools, Jigs, etc. on Contract

LINCOLN Contract Service

All made exactly to your specifications, at lower cost than you'd expect, and delivered on time. A modern, fully equipped plant at your service. Quotations cheerfully given—send blueprints or samples.

Lincoln Machine Co., Pawtucket, R. I.

SWAGING
YOUR SPECIFICATIONS
Phonograph Needle Mfg. Co., Inc.
42-46 Dudley St. Providence, R. I.

CONTRACT MACHINE WORK ON PRODUCTION BASIS

Machine parts or complete machines on contract. Our factory is equipped to handle any volume of medium machine work accurately and economically. Send us your blueprints and specifications for quotations.

MERCHANT & EVANS CO.
Philadelphia, Penna.

IF YOU HAVE WORK TO GIVE OUT, WRITE TO THE CONCERNS IN THE CONTRACT WORK SECTION.

New England factory with
WELL EQUIPPED MACHINE SHOP
capable of high class production work, also
SHEET METAL DEPARTMENT
equipped to fabricate stainless steel, copper or mild steel products, can handle outside work equivalent to one thousand man hours per month.
CW-705, American Machinist
330 West 42nd St., New York City

CONTRACT MANUFACTURING

We are prepared to manufacture machines or parts at low cost. We operate our own foundry, machine and sheet metal shops. Our facilities are such that we can even warehouse and ship in your name. Send us your blue prints or samples for estimate.

CATSKILL METAL WORKS, INC.
CATSKILL, NEW YORK

SEARCHLIGHT SECTION

EMPLOYMENT : BUSINESS : OPPORTUNITIES : EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.

Position wanted (full or part-time salaried employment only) ½ the above rates, payable in advance.

(See ¶ on Box Numbers)

Proposals, 40 cents a line an insertion.

INFORMATION

Box Numbers in care of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads. Replies forwarded without extra charge.

Discount of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

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The advertising rate is $6.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column. 3 columns—30 inches—to a page. A.M.

Copy for new advertisements must be received by 10 A.M. TUESDAY to appear in the issue out Wednesday of the following week.

POSITIONS VACANT

EXPERIENCED MACHINE TOOL Designer wanted for extensive development program by established precision grinding machine manufacturer in New England. Also want draftsmen for machine equipment design. P-697, American Machinist, 330 W. 42nd St., New York, N. Y.

CHIEF ENGINEER WANTED experienced in machine design, having had charge of forty or more in an engineering department. Excellent opportunity for man with outstanding engineering and executive ability. Location middle west. State full particulars and enclose photo. Address P-706, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

MACHINE SHOP SUPERINTENDENT wanted for manufacturing plant in heavy goods industry, who has had considerable experience in this work. Plant employs 160 men. Reply kept confidential. Permanent position for proper applicant. P-707, American Machinist, 330 W. 42nd St., New York, N. Y.

WANTED—Experienced cost and time study man for plant manufacturing heavy goods machinery. Permanent position for proper applicant. P-708, American Machinist, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 30 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo, N. Y.

ABOVE AVERAGE TECHNICAL MEN seeking new connections are invited to file confidential applications. Need immediately: Executive Chief Engineer (40) light machinery and sheet metal manufacturer, salary about $7500; assistant factory manager, also chief inspector with tool background for same industry $4000-$5000. Designers—Hydraulic-Paving-Printing, etc. Machinery. Young graduate mechanical engineers and others. Send complete record and photograph to Patton Personnel Engineers, 53 West Jackson, Chicago. (17 years experience.)

POSITIONS WANTED

(See also Salesmen Available)

MR. PRESIDENT. Are you satisfied with the profits on your manufacturing business? You can secure the services of an executive with 25 years experience in the development, tooling and manufacturing of high quality mechanical products with nationally known concerns. PW-689, American Machinist, 330 W. 42nd St., New York, N. Y.

AUTOMATIC SCREW MACHINE Superintendent or Foreman. Twenty-five years experience on Automatics, mostly Brown & Sharpe. Thorough knowledge of cams, tools and modern production methods. Location immaterial. PW-694, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

CHIEF TOOL ENGINEER

▶ DESIRES TO MAKE CHANGE

Twenty-two years experience in tool, die and machine design. At present responsible for both tool and engineering departments. Write

PW-704, American Machinist
330 W. 42nd St., New York City

Works Manager or Superintendent available

—for the past five years superintendent of entire manufacturing departments of large company; previous twenty years with the same organization, as foreman of assembly department, supervisor of all assembly, supervisor of all machine work. Have thorough familiarity with shop methods and ability to handle men.

REPLY: **PW-692**, American Machinist, 330 W. 42 St., New York City

POSITIONS WANTED

INVENTOR, DESIGNING ENGINEER, with 20 years experience with nationally known concern on high grade mechanical products. PW-688, American Machinist, 330 W 42nd St., New York, N. Y.

Sweden U. S. citizen desires position, preferably in New Jersey. Have many years experience in the making, manufacturing and production designing of high grade scientific instruments. Have held the following positions, Gage Superintendent, Engineering Inspector, and Factory Manager. Reply to PW-680, American Machinist, 330 W. 42nd St., New York, N. Y.

SUPERVISOR OF TOOL & gage inspection or similar position. Wide experience in tool and gage insp. and design, supervision of help, modern mfg. methods. Some technical training. Address JJ, PW-709, American Machinist, 330 W. 42nd St., New York, N. Y.

VERSATILE MAN open to approach—unusually complete training and experience in all manufacturing functions. Fine record of performance. An inherent mechanic with proven ingenuity and inventive ability. Has enviable record for conceiving and developing new machies, methods and tools. 39 years old. Employed. Inquiries for desirable connection invited. PW-710, American Machinist, 330 W. 42nd St., New York, N. Y.

BUSINESS OPPORTUNITIES

For Sale Shop Rights

In Patent number 1,863,076 consisting of hydraulic, circuit covering remote control on lathes, planers, drilling machines, etc. Turner Engineers, Springfield, Vermont.

SALESMAN AVAILABLE

SALES ENGINEER, calling on Chicago area Metal Working Industrials, and with established office and warehouse, wants additional tool lines. SA-703, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

PATENT ATTORNEY

PATENTS—Booklet free. Highest references. Best results. Watson E. Coleman, Patent Lawyer, 724 Ninth Street, Washington, D. C.

AGENCY AND MANUFACTURING FACILITIES AVAILABLE

THE CENTRAL TOOL & EQUIPMENT CO., Ltd., of Central House, Upper Woburn Place, London, W. C. 1, England, are in a unique position to give modern service in developing the sales of American-made high class Machine Tools and special machinery on an exclusive agency basis. Arrangements, where practicable, can also be made to produce in England on royalty payment lines, especially where substantial patents cover the equipment.

FOR SALE

Complete Machine & Repair Shop

Now operating to capacity at substantial profits

With Land and Buildings

WONDERFUL OPPORTUNITY

(Terms If Desired)

FRACKVILLE SHOPS

Formerly Hill and Seuender

Frackville, Pa.

Telephone—Frackville-148

#6 BESLEY 24" MD Ring Grinder with 2—7½ H.P. 3-60-220-1050 motors with controls; machine equipped with ring grinding wheels; serial #6343.

#2 RYERSON-LENNOX Throatless Bevel Shear; #4292; ¾" plate cap.; arranged for MD (no motor).

#2 DIAMOND Surface Grinder; 12" x 34" with countershaft and pump.

Industrial Machinery Co., Inc.

2200-2300 Fletcher Ave. Indianapolis, Ind.

Market 2002

4 **Spindle #3 Avey Drill,** M.D.
#2-D **Colburn Drill**
#3-A **High Speed Hammer,** H.D.
#1 **Adams Gear Hobber**

D. E. DONY MACHINERY CO.

47 LAURELTON ROAD
ROCHESTER, N. Y.

PLANER

Sellers 54"x54"x18' Table 4 Head Motor Driven Planer, Excellent Condition. Must be moved. Address reply to

FS-711, American Machinist,
330 W. 42nd St., New York City

THE WORLD'S LARGEST STOCK OF MACHINE TOOLS

PLANERS
HEADERS
MISC. MACHINES
BENDING BRAKES
GEAR MACHINES
SWAGERS
LAPPERS
CENTERING MACHINES
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GRINDERS
SLOTTERS
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TESTERS
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LATHES
UPSETTERS
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GRINDERS
BULLDOZERS
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WELDERS
PRESSES
THREADERS
FORGING ROLLS
PUMPS
HONERS
TAPPERS
WIRE COILERS

THE DIVERSIFICATION OF OUR STOCK ENABLES US TO QUOTE ON THE REQUIREMENTS OF PRACTICALLY EVERY FIELD OF INDUSTRY . . . YOU ARE CORDIALLY INVITED TO PAY US A PERSONAL VISIT TO OUR CHICAGO PLANTS. WE HAVE TAKEN CARE OF THOUSANDS OF INQUIRIES . . . GIVE US AN OPPORTUNITY TO QUOTE ON YOUR NEEDS . . . WHETHER YOUR REQUIREMENTS MAY BE LARGE OR SMALL . . . OUR PERSONNEL STANDS READY TO SERVE YOU. . . .

• Illustrations are of various bays in our plants, which contain nine overhead cranes inside carloading facilities which insures quick handling and prompt shipment

LOUIS E. EMERMAN & CO.

1763 ELSTON AVE., CHICAGO, ILL.

SEARCHLIGHT SECTION

GRINDERS

No. 3 Cincinnati Centerless, five motor drive
No. 50, 55, 60, 65 Heald Cylinder
No. 51 Besly Disc, M.D.
No. 4, 6 Gardner Disc, M.D.
No. 20 Gardner Combination Disc, M.D.
No. 120 Gardner Disc, M.D.
3 H.P. Black & Deker Emery
Mitchell Engineering Type A1 Polisher, M.D.
No. 3 Bryant Semi-Automatic Hole, M.D.
No. 11 Giddings & Lewis Teromatic, 3 mtr. dr.
No. 12 Bryant Semi-Automatic Hole M.D.
No. 15A Bryant Plain Semi-Automatic 2 spindle Hole and Face, M.D.
No. 1 Wilmarth & Morman Universal, belt
No. 3 Wilmarth & Morman Auto. Surface, belt
No. 10U Norton Lapper, M.D.
No. 33 Abrasive Vertical Surface, M.D.
6x10x36" Norton Type G Surface, M.D.
12x36" Diamond Surface, M.D.
14" Pratt & Whitney Vertical Surface, M.D.
14" Pratt & Whitney Vertical Surface, M.D., ball bearing
15x15x72" Norton Open Side Surface, M.D.
18x48" Diamond Light Duty Face, M.D.
30"x84" Diamond H.D. Face, M.D.
60" Bridgeport Face, M.D.
Springfield Planer Type Surface, M.D.
No. 3 Brown & Sharpe Planer Type, belt
Gisholt Universal Tool, belt
18" Cincinnati Face, M.D.
Sellers Drill, M.D.
No. 1 ½ Cincinnati Tool and Cutter, belt
Gleason Cutter, belt
No. 4, 5 Oliver Motor Driven Drill Pointer
6x18", 10x24", 10x36", 10x52", 10x72", 12x36", 12x52", 12x72", 16x36", 16x52", 16x72", 20x144", Landis Plain Self-Contained Cylindrical, motor drive
6x32" Norton, M.D.
8x30" Modern, M.D.
8x18" Cincinnati Saddle Type, M.D.
8x36" Cincinnati Saddle Type, M.D.
10x18" Brown & Sharpe, belt
10x36" Landis Integral Cam, M.D.
10x36" Norton Cylindrical, M.D.
10x36", 10x50", 16x36" Norton belt
10x50", 10x72", 14x72" Norton, M.D., late
12x18" Cincinnati, 3 motor drive

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19"x12' Leblond Hvy. Q.C. Lathe
18"x6' Monarch Q.C. Lathe
16"x6' American Q.C. Taper Att.
16"x6' Cinn. Q.C. Lathe Taper Att.
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16"x8' Bradford Q.C. Lathe

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4' American Radial Drill S.P.D.
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36" and 30" Sl. Hd. Drill Presses
24" Cincinnati Drills Tapp Att.
#3 Bausch Multiple 32 spl.

PUNCH PRESSES

#99 Stoll Toggle Press 5" crk.

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24" Kelly, cone drive Shaper
24" Gould & Eberhard Shaper
20" Steptoe Shaper S.P.D.
36x36" Ohio Planer 2 Hds.
24"x24"x6' Grey Planer arr. MD.

GRINDERS

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14"x50" Norton Plain M.D.
12"x30" B. & S. Plain #14
16"x32" Landis Universal
13"x40" Modern Universal
#3 Van Norman Internal Grinder
#7½ Gardner B.B. Disc Grinder Motor Dr.
#3 Ohio Tool & Cutter Grinder
#78 W&M Surface Grinder
#2 Reed Surface Grinder
#2 Bath Universal Grinder

MISCELLANEOUS

6 Spdl Holmes Nut Tapper
#12-#10 B & G Screw Machines
60 KVA Gibbs Spot Welder Air Op
300 Amp Hobart Ark Welder
10—#2-#2X Garvin Vert. Tappers
#411F Tol. Pr. Sq. Shear 11 Ga.
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#12 Barber Colman Hobber
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4' Hammond elbow arm
4' Mueller
5' American triple purpose
6' Niles Bement Pond universal

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24"x24"x6' Gray
24"x24"x8' Rockford
32"x32"x12' Niles
36"x36"x10' Cincinnati
36"x36"x16' Cleveland openside
42"x30"x10' Liberty openside
48"x36"x10' Liberty openside
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Hammer, 100 lb. Little Giant, belted.
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G & E 16″ SPLINE HOBBER
G & E #36 H GEAR HOBBERS
B. & S. #13H GEAR CUTTER
B & S #6—72″ GEAR CUTTER, LATE
NEWARK #7 GEAR CUTTER. 84″ CAP.
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HANSON WHITNEY THREAD MILLER
LEES BRADNER #8 THREAD MILLER
FOSTER #1B TURRET LATHE
W&S #4 GR. HD. UNIV. TUR. LATHE
AMERICAN 16x8′ GRD. HD. LATHE
PUTNAM 36″x28′ GRD. HD. LATHE
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No. 31 Lucas, 3″ bar, motor drive
No. 1 Cleveland, 2⅛″ bar

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30″, 36″ King
42″ Gisholt, arr. motor drive
42″, 52″ King
48″, 54″, 60″ Colburn
60″ Gisholt, motor drive
72″ King, Motor Drive
72″ Niles-Bement-Pond, motor drive
10′ Niles

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No. 12 Colburn, 1 spindle
No. D-4 Colburn Heavy Duty
No. 314 Baker Heavy Duty
No. 14 Natco Multiple
No. 1, No. 3, No. 4 Baush Multiple

Radials, 3′ Western Plain
3′ American Triple Purpose, motor on arm
4′ Carlton Plain, Motor Drive
4′ Western Heavy
4′, 5′ American Triple Purpose
6′ Western, Plain
7′, 8′ Western Heavy

Gear Cutters, No. ½, No. 1 Pfauter Hobber
No. 4—36″, No. 4—48″ Brown & Sharpe
No. 2, No. 3 Pfauter Hobber
No. 2—60″ Goss Hobber
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No. 18H Gould & Eberhardt Hobber
No. 24HS Gould & Eberhardt Hobber
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No. 22—12″ Heald Rotary Surface
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10″x18″	10″x15″	GAPx72″	16″x72″
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10″—15″ GAPx24″	14″x36″	18″—24″	GAPx96″
	14″x50″		21″x96″
10″x36″	14″x72″		20″x144″
10″x50″	14″x96″		23″x120″

Lathes, 14″x6′ Lodge & Shipley Geared Head
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16″x7′ Lehmann Grd. Hd., Taper Att.
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27″x18′ Sidney, Taper Attachment
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No. 4 Cincinnati High Power Plain
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No. 3 Cincinnati Universal
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No. 3-B Milwaukee Vertical
No. 3 Standard Milwaukee Vertical Rotary
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No. 5—48″ Cincinnati Pl. Hydromatic M.D.
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42″x42″x30′ Niles Bement Pond, rev. M.D.
44″x36″x12′ Gray
48x48″x10′ Niles-Bement-Pond
72″x48″x10′ Cincinnati
72″x60″x16′ American

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Nos. 1, 1½ V & O, O.B.I., Motor Drive
No. 20 Bliss, O.B.I., Motor Drive
No. CG 24 Ferracute Grd., O.B.I., Motor Drive
No. 3, No. 5 V & O Geared, O.B.I., M.D.

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No. 5 Foster Univ., Timken Bearing M.D.
No. 1-B Foster Universal
No. 1-A Warner & Swasey, Motor Drive
No. 2-B Foster Univ., Timken Bearing, M.D.
No. 2-A Warner & Swasey, A.C. & R.F.
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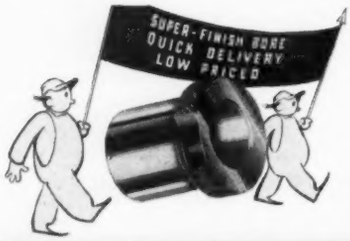

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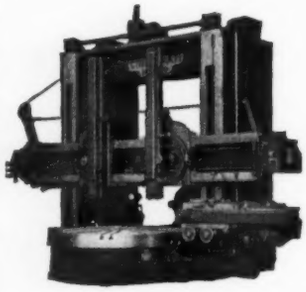

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Planer Type Millers

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BOOKS, Technical
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Consolidated Mach. Tool Corp., Rochester, N. Y.
Modern Tool Wks., Rochester, N. Y.

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Taft Peirce Mfg. Co., Woonsocket, R. I.

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Consolidated Mach. Tool Corp., Rochester, N. Y.
Landis Tool Company, Waynesboro, Pa.
Lucas Mach. Tool Co., Cleveland, Ohio
Modern Tool Wks., Rochester, N. Y.
Niles Tool Wks. Co., Hamilton, Ohio
Putnam Mach. Co., Hamilton, Ohio
Springfield Mach. Tool Co., Springfield, Ohio

BORING Machine, Jig
Linley Brothers Co., Bridgeport, Conn.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

BORING Machine, T. C. Tool
Heald Mach. Co., Worcester, Mass.

BORING Machines, Vertical
Bullard Co., Bridgeport, Conn.

BORING Tools
Carboloy Co., Detroit, Mich.
Ready Tool Co., Bridgeport, Conn.

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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

BRAKES, Press
Cincinnati Shaper Co., Cincinnati, Ohio

BROACHING Machines
Cincinnati Milling Mach. Co., Cincinnati, Ohio

BURNERS, Oil and Gas
Hones, Inc., Chas. A., Baldwin, N. Y.

BUSHINGS, Drill and Jig
Universal Engineering Co., Frankenmuth, Mich.

CALIPERS
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Randall & Stickney, Waltham, Mass.

CAMS
Hartford Special Machy. Co., Hartford, Conn.

CAP Screws
Baumbach Mfg. Co., E. A., Chicago, Ill.

CARBIDE Alloys
Carboloy Co., Detroit, Mich.

CASTINGS, Aluminum
Aluminum Co. of America, Pittsburgh, Pa.

CASTINGS, Gray Iron
Brown & Sharpe Mfg. Co., Providence, R. I.

CASTINGS, Iron and Semi-Steel
Etna Machine Co., Toledo, Ohio
Springfield Mach. Tool Co., Springfield, Ohio

CENTERING MACHINES
Hanson-Whitney Machine Co., Hartford, Conn.

CENTERPOINTS
Dearborn Gage Co., Dearborn, Mich.

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Noble & Westbrook Mfg. Co., Hartford, Conn.

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Goss & DeLeeuw Mach. Co., New Britain, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Kingsbury Mach. Tool Corp., Keene, N. H.
Potter & Johnston Mach. Co., Pawtucket, R. I.

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Errington Mech. Lab., Staten Island, N. Y.

CHUCKS, Drill and Tap
Errington Mechanical Lab., Staten Island, N. Y.

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Errington Mech. Lab., Staten Island, N. Y.

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Heald Machine Co., Worcester, Mass.
Taft Peirce Mfg. Co., Woonsocket, R. I.

CHUCKS, Spring
Brown & Sharpe Mfg. Co., Providence, R. I.

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Bullard Co., Bridgeport, Conn.

CLUTCHES, Friction
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

COLLETS
Brown & Sharpe Mfg. Co., Providence, R. I.
Union Twist Drill Co., Athol, Mass.

COLLETS, Lathe
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Stark Tool Co., Waltham, Mass.

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Sun Oil Co., Philadelphia, Pa.

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General Electric Co., Schenectady, N. Y.

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Bakelite Corp., New York, N. Y.

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Coulter Machine Co., James, Bridgeport, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Designers for Industry, New York, N. Y.
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Johnson Mach. Co., Carlyle, Manchester, Conn.
Lincoln Mach. Co., Pawtucket, R. I.
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Waltham Mach. Wks., Waltham, Mass.

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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CONVERTORS, Synchronous
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Dony Machry. Co., D. E., Rochester, N. Y.
Eastern Machy. Co., Cincinnati, Ohio
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Indianapolis Machy. & Supply Co., Indianapolis, Ind.
Industrial Machy. Co., Indianapolis, Ind.
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Miles Machy. Co., Saginaw, W. S., Mich.
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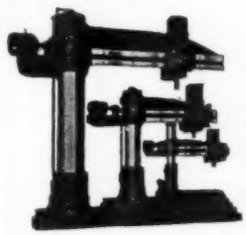

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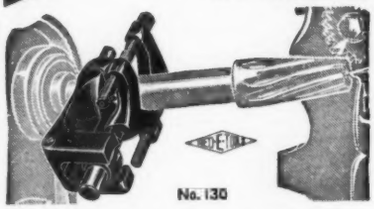

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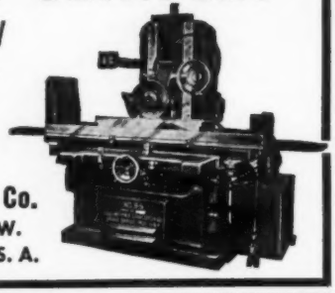

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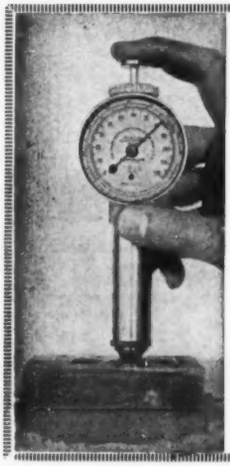

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Production Machine Co., Greenfield, Mass.

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DRILLS, Ratchet
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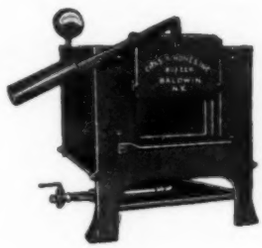

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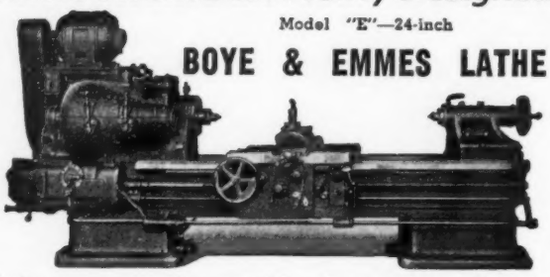

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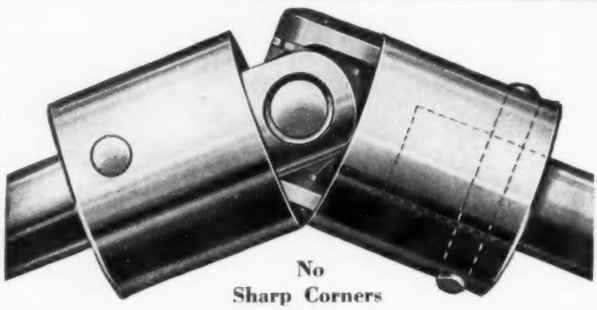

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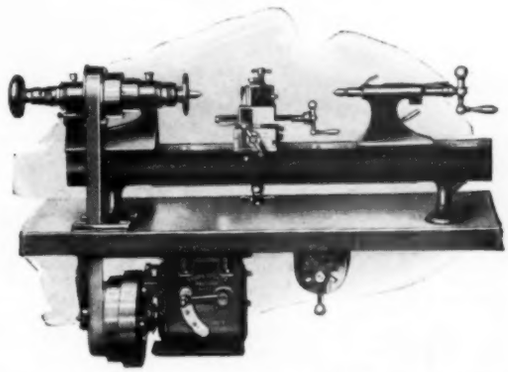

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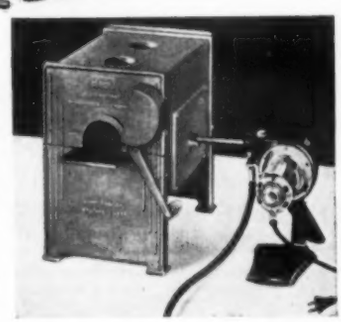

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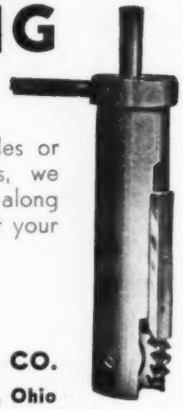

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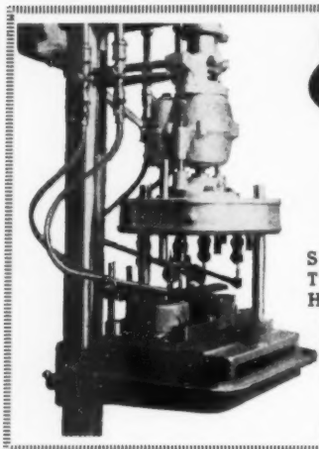

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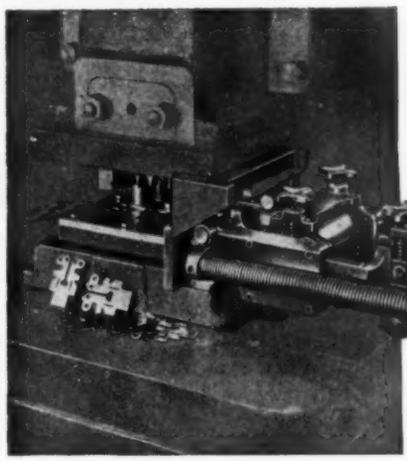

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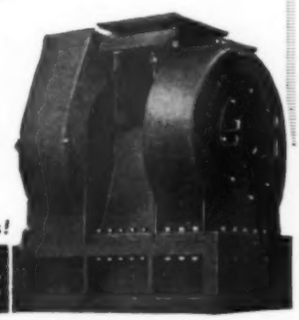

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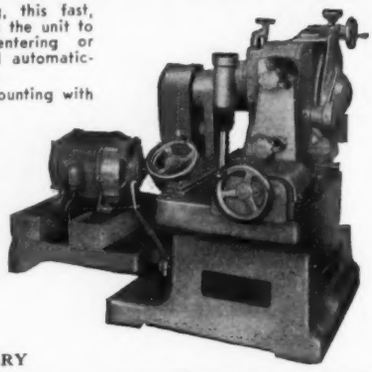

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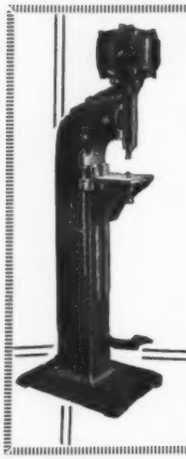

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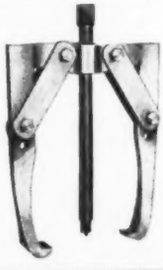

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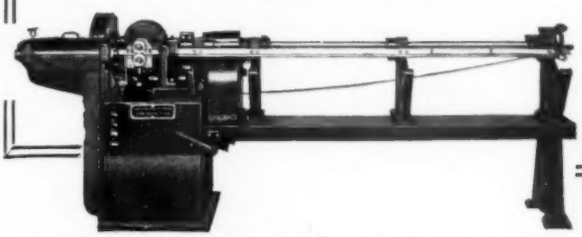
PAY FOR THEMSELVES IN SAVINGS . . .



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SHUSTER offers these machines in five different sizes for handling wire stock from 5/8" to 1/32" diameter.

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Wire Machinery Specialists Since 1866

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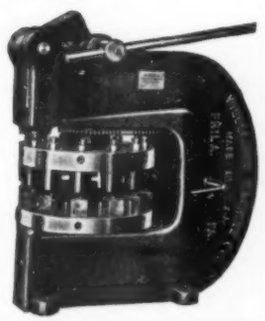
⅛" thick, holes up to 1" dia.

Simple, inexpensive punches and dies available for accurate holes in copper, aluminum, duralumin, etc.

Full details on request.



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